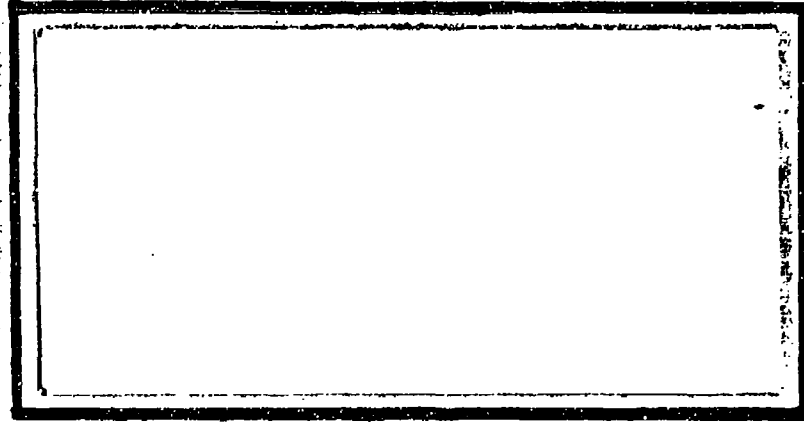


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LOGISTICS OF AIRCRAFT MAINTENANCE  
DURING THE KOREAN WAR  
THESIS

James I. Forney  
Captain, USAF

AFIT/GSM/LS/88S-7

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LOGISTICS OF AIRCRAFT MAINTENANCE DURING THE KOREAN WAR

THESIS

Presented to the Faculty of the School of Systems and Logistics  
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the  
Requirement for the Degree of  
Master of Science in Systems Management

James I. Forney, B.S.

Captain, USAF

September 1988

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James I. Forney

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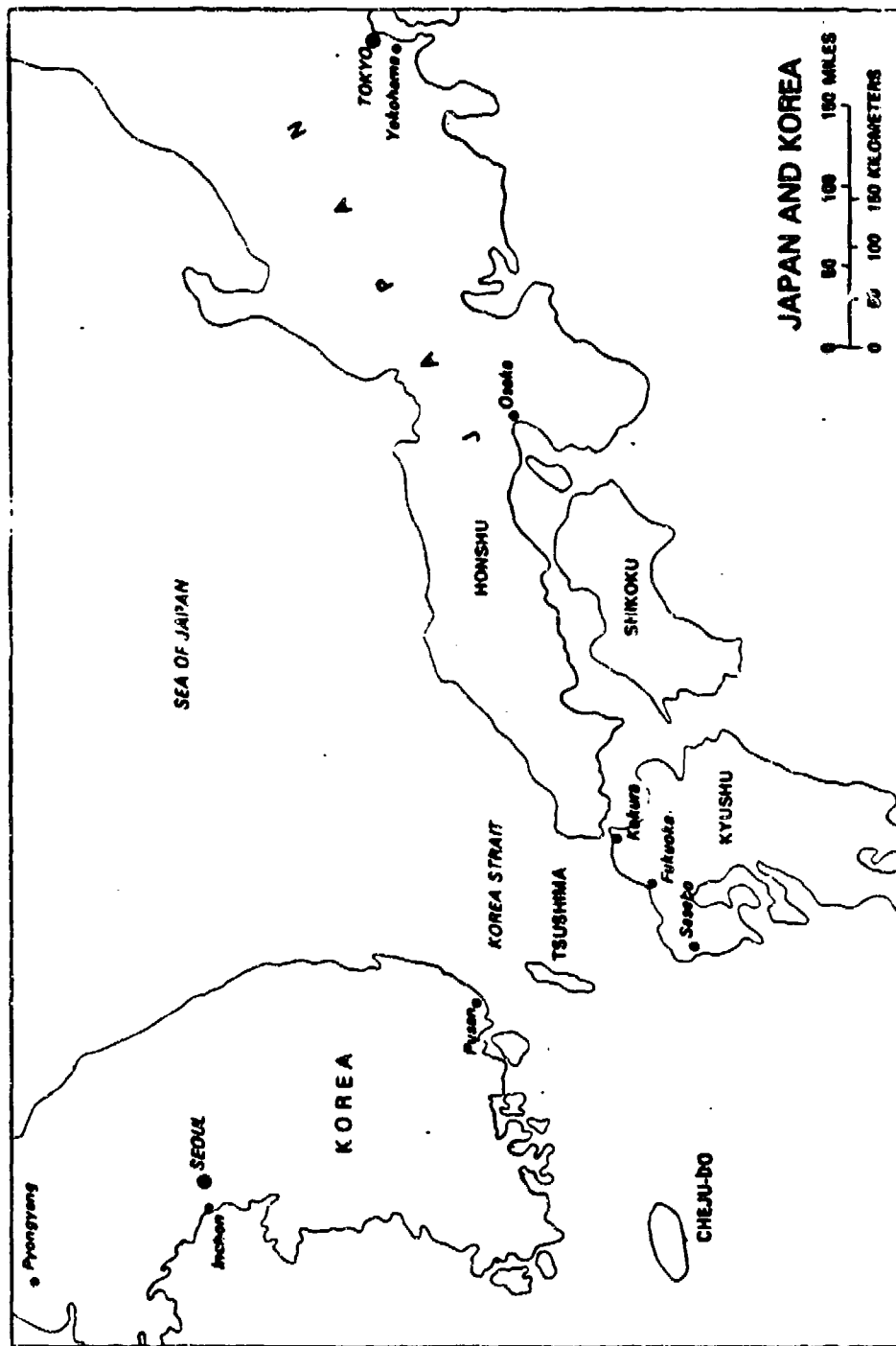
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Abstract

The objective of this research was to review historical literature relating to the logistics of aircraft maintenance during the Korean War, determine the principle problems encountered, find the corrective actions, and evaluate the results. The general theme was to provide a brief single source of reference relative to the accomplishment of aircraft maintenance in the combat area during the Korean War. This report was written to provide helpful insights for solving possible future wartime logistics problems in support of aircraft maintenance. The research discusses how aircraft maintenance was supported by the Fifth Air Force, the Far East Air Force, the Air Materiel Command, and other organizations. The logistics of aircraft maintenance was broken into four areas: (1) maintenance, (2) supply, (3) transportation, and (4) personnel. Each area was discussed by presenting the actions taken by the different Air Force organizations in the theatre. The lessons learned by the Air Force during and after the war were included in this research paper to exemplify specific areas of concern when planning for or performing future aircraft maintenance operations in a limited conventional war.







# LOGISTICS OF AIRCRAFT MAINTENANCE DURING THE KOREAN WAR

## I. Introduction

### General Problem

Even though aircraft have changed dramatically over the years due to advances in technology they still require maintenance to insure they continually operate at peak performance. With the advances in technology have come changes to maintenance procedures and test equipment, and increased needs for higher quality parts. Computers and other advanced electronic equipment are now standard equipment on aircraft and on support equipment. Maintenance technicians must be knowledgeable in advanced areas of electronics and hydraulics to properly repair aircraft and support equipment. Further, they must have appropriate supply support, on-time, because many components of aircraft cannot be repaired on the aircraft or on the flight line. Replacement parts are essential.

Even with all the advances, some basic maintenance requirements still remain. These include; (a) sufficient supplies of spare parts stockpiled for future use during peacetime, as well as wartime; (b) maintenance personnel properly trained to maintain the aircraft; and (c) plans to insure those supplies which are not readily available can be

obtained quickly. Due to national budget restraints, and political pressures, the military must operate on fixed annual budgets, which unfortunately, cannot be reliably forecast for the coming years. Priorities must be applied to decide how limited financial and material resources must be allocated. Restrictions and reductions of funds for aircraft spare parts, and for maintenance personnel, must be offset through careful planning and the streamlining of procedures, policies, and methods. Arrangements must be made to assure operating organizations are provided sufficient qualified personnel and mission critical supplies. This is of even greater importance as plans are developed and personnel are trained for accomplishing aircraft maintenance in combat areas.

Having the proper repair manuals or enough spare parts to maintain aircraft cannot be taken for granted. There are far more aircraft containing sophisticated and highly technical parts than there were during past United States wars. Components for aircraft systems now take considerably more time to fabricate and more time to obtain when needed. The components are frequently expensive and large quantities cannot be procured. Organizations in all levels of the Air Force must plan for the logistical aspects of aircraft maintenance (including their budgets) to insure aircraft receive the care they require to be ready for mission demands.

Combat support in remote areas of the world, such as the Middle East, requires immense logistical support and long logistics pipelines. In some locations of the world, large maintenance and supply facilities may not be close enough to areas of conflict to immediately support combat missions. Of course, aircraft maintenance is more difficult to accomplish, and sometimes impossible, when critical parts are not readily available. This is often one of the results of stretched supply pipelines and long logistics trails from the United States.

Problems with aircraft maintenance due to long supply lines, budget constraints, and operations near or in an area of active conflict may be solved in two basic ways: (a) learning through experience, or (b) learning from past events. Learning through experience may be time consuming and costly and it cannot be obtained under combat conditions in a peace-time world. Where applicable, knowledge of historical events might permit quick solutions for important combat maintenance support planning and decisions. It might also save lives and money by avoiding duplication of past mistakes in combat areas or in support of combat areas.

A study of logistical actions supporting aircraft maintenance in past wars could be of immeasurable current and future help if the resulting knowledge was used (1) to correct on-going mistakes and omissions or (2) to provide planning and preparation guidance for future operations.

The study of military logistics history will help the logistician, and the student of logistics, to more readily identify current problems and it will suggest potential avenues of solutions for those problems [33:3].

The Korean War was the United States' first jet air war and its last "conventional" war. Activities of the United States Air Force (USAF) during that war can provide important information about the USAF's potential limitations, problems, and accomplishments in wartime logistics. The condensing of available Korean War historical information about aircraft maintenance will provide a concise source of learning about maintenance problems which occurred in wartime situations and in combat areas.

#### Specific Objective

The purpose of this research was to identify, evaluate, and report principle logistics factors of USAF aircraft maintenance during the Korean War.

Unfortunately, while the USAF collected masses of unit and command histories, and other documentary materials, during the Korean War, little of it specifically addressed aircraft maintenance. Some of the unit histories provided statistics relative to specific tasks accomplished (engines changed, engines overhauled, and the like) but not much else about maintenance or supply and their related logistics problems. Major problems and difficulties seem to have been avoided in the writing of the unit histories and the few

magazine or journal articles of the time which address any logistics function of the USAF's war effort. On the other hand, there was a good quantity of historical material about all facets of military logistics from the Army and some coverage from the Navy. Why the Air Force avoided, or omitted, logistics planning, maintenance, supply, transportation, and procurement historical writing by unit historians in the Korean War is unknown. Reading the Air Force unit and command histories could possibly leave the unaware reader with the impression there were no major logistics problems during the Korean War.

Yet, people who served in Korea during the war testify to the presence of many logistics problems. Those who performed maintenance, or managed maintenance activities, tell many tales of difficulties and problems, and the innovative efforts to overcome them. But, these problems and difficulties, and the creativity of the maintenance and supply personnel, were not included in the histories as a general rule. Again, the reason for omission is not known.

#### Research Objectives

This research grew from the concern that the USAF, as an organization, does very little to provide historical education for its personnel. This is particularly true of personnel working in logistics specialty areas which support combat operations. Although these personnel receive highly advanced training in their technical specialty area,

historical experiences of their specialties during combat are usually overlooked or not covered in training or, later, on the job.

The USAF does acquaint some of its members with historical events through the "Project Warrior" program. This program describes past wartime events, through speeches and articles, by high level personnel. Although important information has been passed on through this project, the information usually describes heroic air operations. Detailed accounts of air-to-air combat, tactical planning, and the deeds of flight crews constitute the majority of the historical events covered. Omitted are the experiences of the majority of the Air Force, those supporting the flight crews. "Project Warrior" generally does not discuss maintenance personnel repairing planes with little or no supplies. Nor does it usually discuss the experiences of ground personnel in stressful combat support situations who are required to repair aircraft without the necessary technical knowledge or without sufficient spare parts while maintaining effective, combat-ready aircraft.

Very little written material was readily available on the USAF aircraft maintenance activities in the Korean War. Also, at the time of this research there was little oral information available because the Korean War participants have retired or died, and logistics personnel have not regularly been included in any oral history programs. Very



few of the available publications directly address the subject of aircraft maintenance at the unit level in the Korean War. Most of the information on the subject was found through articles on aircraft performance and documents discussing the histories of several major air commands. This information usually described events which occurred for only a short period. The description in this report of aircraft maintenance during the war was made by tying piecemeal information together and generalizing important facts from a relatively few documents. But, such description is vital for the education of today's USAF maintenance and logistic forces because nothing else is available.

The majority of the available Korean War aircraft maintenance information was discovered only through exhaustive research in the archives of the Air Force Historical Research Center, Maxwell AFB. This material is not available to the general public as a rule, and is not condensed and published in a single document. Individuals or organizations would have to devote considerable time and effort to research in order to make this mass of documentation useful. There was no one source which wrote extensively about aircraft maintenance in the Korean War, as some sources did for World War II, so no popular information exists. This thesis was designed to, at least partially, remedy the situation.

The principle objective of this research was to document lessons learned from USAF maintenance activities during the Korean War and put them into a readable format for the benefit of future readers. A second objective was to develop, for future use, a bibliography covering the history of USAF aircraft maintenance during the Korean War. This information should be invaluable because such a listing is not now available. Further, there is a high likelihood the next war the USAF might be involved in could be geographically constrained comparable to the Korean War. The lack of an opportunity to learn from the past, as is currently the case, could mean the costly and potentially dangerous situation in which historical lessons might have to be relearned through expensive, painful, and perhaps fatal experiences. This document, and information from the cited sources, will help bridge the gap between current knowledge and knowledge which can be gained only through combat and combat support under threat and extreme urgency.

#### Definitions

During the Korean War, logistics was considered the activity which dealt with design and development, acquisition, storage, movement, distribution, maintenance, evacuation, and disposition of material, facilities, and services (2:2). Logistics provided the means to keep the military forces in operation. Logistics consisted of requirements, procurement, distribution, and maintenance.

Requirements determined what resources were needed.

Procurement acquired the resources to meet the determined requirements. Distribution moved, stored, and otherwise handled the items. Maintenance cared for and conserved the resources in the system.

Aircraft maintenance during the Korean War was defined as the normal upkeep and preservation of aircraft which may be expected to recur from time to time in consequences of usage, wear and tear, or deterioration by the elements (2:3). Aircraft maintenance was the phase of logistics which kept the aircraft in operational condition or repaired it and again made it ready to fulfill its mission. During the Korean War, aircraft maintenance was classified in three echelons: organizational, field, and depot. Organizational, or preventive, maintenance concerned such activities as pre-flight inspections and minor repairs and was usually accomplished by the operational unit. Field, or corrective, maintenance was aimed at repairing or correcting defects beyond the capability of organizational maintenance. It was usually accomplished by field maintenance squadrons assigned to the operational group or wing. Depot, or restorative, maintenance was used to restore worn or damaged equipment to serviceable condition and to periodically overhaul assemblies. It was usually accomplished by a specified element of the Air Materiel Command or at a designated contractor facility. In Korea each operational USAF wing

was responsible for the organizational and field maintenance of its own aircraft including ordering and stocking spare parts, keeping its maintenance personnel well trained, and insuring the supply pipeline was open to send and receive materials. Maintenance jobs which could not be done by one echelon were given to the next higher echelon to complete.

Organizational maintenance consisted of preventive maintenance operations performed by the user or operator. "Its purpose was to prevent trouble through daily servicing, minor repairs, and necessary adjustments" (37:9). This maintenance was performed with small hand tools, and consisted of cleaning, servicing, pre-flight inspections, rearming, refueling, and other common tasks which required a limited amount of time. This echelon also took care of changing engines and performing some riveting of minor sheet metal patches.

Field maintenance was performed by a field maintenance squadron or a service group at the base or wing level. It consisted of corrective maintenance which was beyond the scope of the using organizations (37:10). Some of the duties consisted of replacing major unit assemblies, fabrication of parts, complying with technical orders, and otherwise assisting the using organizations. Fixed shops, skilled mechanics, and heavy and precision tools were usually required to perform field maintenance. During the

Korean War, the tactical and service groups were normally under the same wing commander.

Depot maintenance was performed at air depots under the control of the Air Materiel Command (AMC) which is now called the Air Force Logistics Command (AFLC). The depots provided the major maintenance for almost anything used by the USAF (37:10). Activities at the depots included any work which was required to return a badly damaged or malfunctioning airplane to operational condition. Periodic overhauls of engines and aircraft, replacement and reclamation work, flight tests, and periodic inspections were some of the jobs performed at the depots. During the war, the depot maintenance on aircraft used in Korea was performed by depots in Japan. If the work could not be performed by depot shops in Japan it would be sent to the Zone of the Interior (ZI), the United States.

A Rear Echelon Maintenance Combined Organization (REMCO) was an organization consisting of major elements of the maintenance units of several wings, flying the same type aircraft. This combined unit was located in Japan at a base to the rear of the operating bases in the combat zones.

The original REMCO was conceived in 1951 as a temporary expedient for the sole purpose of keeping heavy maintenance functions, both men and equipment, out of the forward combat areas (29:31).

Since the bases in Korea could not be considered far enough away from enemy control and since some bases had already been overrun at the beginning of the war, the REMCOs were

established in Japan. Some other reasons for creating the REMCO were found in the poor operating conditions in Korea; (1) lack of physical facilities, (2) extreme weather conditions of hot and cold, and (3) the poor quality of indigenous labor (28:21). These problems did not exist in Japan. The REMCOs relieved tactical units stationed in forward areas of responsibilities for field maintenance and some organizational maintenance. Aircraft were flown from their Korean bases to the REMCO base in Japan. REMCOs performed inspections and repair of components, heavy repair, reclamation work, 100-hour inspections, flight tests, and acceptance inspections (29:13). This reduction of on-site support materials, equipment, and personnel allowed fighter wings to move at a moment's notice (16:5). REMCOs were established in February 1952 at Itazuke, Japan for F-84s and F-80s; at Miho, Japan for B-26s; and at Tsuiki, Japan for F-86s (28:22). Although the large majority of the REMCOs were established in Japan, rear area maintenance was also conducted in Korea. Two wings which were stationed near the combat area set up a REMCO in the southern part of Korea, Chinhae, for F-51s.

#### Background

At the end of World War II the United States and the Soviet Union emerged as the two major powers in the world. The Soviet Union immediately started to expand its influence throughout the world with only the United States

capable of controlling the expansion. Tension with the Soviet Union grew with the defeat of Japan and the United States moved to a policy of containment of further communist expansion.

Just prior to the end of the World War II, the American people at home began pushing for the demobilization of the armed forces. After the Japanese surrender, public opinion grew even stronger for immediate demobilization (12:1). Both the Army and Navy had initiated demobilization programs in May 1945. In an effort to be equitable, the services established a point system based on length of service, combat duty, time overseas, military decorations, marital status, and parenthood to determine who would be released first. The plan was basically reasonable and equitable. Those with the highest number of points were to be released first. But, the families in the United States began to clamor for the return of "their boys" from overseas and their release from military service. The family pressure created political pressure and soon the point system was destroyed as masses of men were sent home for discharge.

With the point system, demobilization was basically an individual process governed by the points acquired and by continually changing criteria. Unit strength, effectiveness, and cohesion were not considered. Every military organization world-wide was in some manner effected. For example, in the Army Air Force, experienced

pilots and maintenance personnel were among the first to be released from active duty but, soon, units were being deactivated entirely and the remaining units and personnel were inexperienced and unqualified to meet requirements. This left many Army Air Force units to be operated by inexperienced, replacement personnel unable to accomplish the mission. The War Department estimated the United States military presence in the Pacific, shortly following the surrender of Japan, was only at 25 percent of its wartime efficiency (12:1).

In 1947 President Truman officially called for a doctrine which proclaimed containment of the Soviet Union. The super powers had clearly evolved into adversary relationships. While the United States was demobilizing its military, the Soviet Union did not do the same and it also did not alter its expansionist plans. As each nation put its own interests first, it raised suspicions in the other nation. This set off a policy of "action then reaction" which ultimately led to the Cold War; a period of high tension remarkable only by the lack of military action by one major power against the other (12:2).

Two days after Hiroshima was attacked with the first A-bomb by the United States, the Soviet Union declared war on Japan. Before World War II ended the Soviet Union invaded North Korea. It set up a military government controlled from Pyongyang. Since there was little Japanese resistance,



and there were no United States troops in Korea, the United Nations proposed that the Soviets accept the surrender of the Japanese north of the 38th parallel and the United States accept the surrender south of the 38th parallel (12:13). The division was a temporary measure to speed surrender actions, but the Soviets took it as a permanent boundary. The United States moved troops to Korea from Okinawa to manage the Japanese surrender. Not wanting to see Korea turn into another communist satellite, the United States took over the military government and occupation of South Korea a month after the Soviets had invaded (12:14).

The United Nations (UN) direction for the Soviets to accept Japanese surrender in the North and the United States to do so in the South was not intended to create two countries. The allied powers during the war had twice agreed that the Korean desire for independence would be observed with the peace. However, with the Japanese actions to end the war there was a need to disarm the Japanese troops and return them to Japan. This was the job the Soviets and the United States were to accomplish by the UN's direction. The United States worked to attain the goal of Korean independence and helped the people of the South establish an interim government leading up to the UN-sponsored free elections in 1948. The Soviets refused to allow people north of the 38th parallel to participate in the voting and instead established a strong communist-

controlled government in the North. After the elections, the North began to harass the South in many ways, including brief military incursions below the 38th parallel. In early 1949, the Soviets withdrew their troops from the North but left in place a communist government strongly supported by the Soviets.

The invasion of South Korea by North Korea on 25 June 1950 took the United States and the young United Nations by complete surprise. The United Nations asked its members to assist South Korea and the United States directed military forces into supporting action on 27 June 1950. 'The American military entered the war in Korea in a state of doctrinal and physical unpreparedness' (12:5). The United States had planned that the next war would be another world war. It put tremendous faith on its nuclear power to deter other nations and thus preserve peace. Because of budget constraints, and demobilization, the United States possessed limited conventional military ground and air strength and lacked contingency plans for joint military operations below the level of total war. Thus, as it entered combat in Korea, the United States had to improvise as best it could. For example, pilot skills in close-air-support and interdiction operations had to be developed and improved under the pressure of actual combat.

Immediately following World War II, President Truman had insisted on keeping a lid on defense spending. His

budgetary restrictions severely restricted the ground forces and their ability to function as a combat force. The main objectives of the War Department were to administer demobilization and manage occupation activities in Germany and Japan. The Truman administration employed the threat of nuclear weapons as the alternative to trying to match Soviet strength in conventional forces. There was no planning for limited conventional war such as that experienced in Korea.

As the USAF contingent to the Far East Command (FEC), the Far East Air Force's (FEAF) mission was to maintain an active air defense in the FEC theatre. Subordinate missions for the FEAF were to maintain a mobile air strike force and to provide air support for operations in cooperation with Army and Navy commanders (26:4). The FEAF, headquartered in Japan, had the responsibility for providing logistical support of Air Force technical supplies, Air Force equipment, and ammunition to those operational commands subordinate to Headquarters (HQ) FEAF. Logistical policy was provided by HQ FEAF. The responsibility for providing supply and maintenance support was delegated to the Far East Air Materiel Command (FEAMCOM).

The AMC representative in Korea was the FEAMCOM. Even though the FEAMCOM supported the supply and maintenance needs for the Air Force, it was under the direct control of the FEAF commander. The FEAMCOM, later called Far East Air Logistical Force (FEALogFor), supported maintenance depot

shops in Japan which repaired combat-damaged aircraft, performed periodic overhauls, made modifications to aircraft, and obtained and stocked parts and other materials for aircraft maintenance and support.

At the start of the war the FEAMCOM had two air depots under its jurisdiction: Clark AFB in the Philippines and the HQ FEAMCOM at Tachikawa Air Base, Japan (9:1). Because FEAMCOM was so close to the fighting, it provided the greatest proportion of the support to bases in Japan, Okinawa, and Korea. The depot in the Philippines supported units only in its geographic area. The depot at FEAMCOM, in Japan, had by far the greater mission and provided depot-level support for 93 percent of the the total aircraft in the Far East (9:1). The majority of the aircraft supplies were kept at FEAMCOM for use by the REMCO units in Japan and by air bases in Korea.

At the beginning of the war the military relied on supplies left after World War II in Pacific sites. Because of the lack of sufficient qualified personnel to order supplies, and because of problems obtaining high enough priorities for supplies, the USAF units in Korea had to rely on these World War II surplus supplies for several months into the Korean War (33:152). The demobilization of the United States economy following World War II saw the private sector switch production to civilian consumer goods in lieu of military goods. Therefore, when the United

States entered combat in Korea and began creating high demands for military supplies, producers had to switch again and lead times to manufacture and ship supplies became a major problem affecting USAF forces in Korea.

Maintenance not only meant repairing damaged equipment, but also meant modifying aircraft to match scientific and technological advances (34:109). Since parts were scarce at the beginning of the war, maintenance crews often had to take parts from one plane to fix another. This was called cannibalization and it was expensive in time, labor, and reliability. They also performed many essential modifications to the aircraft on the flight line to enhance performance, such as enlarging F-80 fuel tanks (9:17).

Early in the Korean War the Fifth Air Force wing commanders in Korea were vigorously compelled to decide between accomplishing maintenance following the basic principle of the USAF independent wing-base concept or accomplishing maintenance operations in Japan to support tactical units in Korea (26:599). Under the wing-base concept, each wing was manned and equipped to be as self-sufficient as practical. This required large amounts of flight line and shop equipment and tools and was based on a concept of fixed-base operation. The early war in Korea did not allow fixed bases as the communist forces rapidly over-ran almost all of South Korea. The situation, for more than a year, was highly fluid requiring combat units to be highly

mobile. Air bases had to be evacuated as communist forces surged southward in Korea. Mobility was practically impossible in maintenance units because of the masses of tools and equipment and the impossibility of rapidly moving all of it with the limited transportation available. Roadways either did not exist or were in disrepair and rail transportation was difficult to obtain on short notice.

Under the REMCO system, aircraft maintenance personnel worked in two main areas; on the flight lines in Korea near the combat or safe on air bases in Japan in the REMCOs. The personnel who worked near the combat zones prepared the aircraft just before and after flight and performed minor repairs. The personnel in Korea had difficulties performing maintenance duties due to severe weather, poor working conditions, and sometimes lack of specialized training on certain aircraft types. The personnel in the REMCOs performed 100-hour inspections and repaired aircraft unfit for combat flight. Although personnel stationed in the REMCOs in Japan were able to perform more efficiently than the ones in Korea, morale of the maintenance personnel was a problem (26:599). Morale was a problem because the maintenance personnel in the REMCOs were a mixture from several different units, lacking any unit pride. In both areas, there were shortages of qualified personnel. A policy establishing a one year tour of duty in Korea also proved inefficient because once the personnel were

knowledgeable with the workings of the aircraft they were maintaining, it would be time to change assignments.

Some commanders in Korea were reluctant to fly their aircraft to Japan to have REMCOs perform organizational and field maintenance on their aircraft. Although the purpose of the REMCOs was to allow wings more mobility and to keep heavy maintenance functions out of forward combat areas, they objected to the amount of time needed to transport the aircraft back and forth to the REMCOs and the concentration of skilled maintenance personnel at the REMCOs thus depriving the lesser-skilled men in the forward areas of skilled assistance (26:369). The positive results of the REMCOs in the form of higher aircraft in-commission rates, more flying hours, and generally better maintenance of aircraft made up for the lack of direct accountability to the commanders (26:369). Maintenance which was not, or could not be, supported by military personnel in the REMCOs was contracted to civilian firms which provided excellent support to the bases in Japan during the Korean War (53:42).

Supplies from the United States were transported by sea and air from the ZI to Japan and the Philippine Islands (PI), where the supplies would be redistributed to the using commands. The Military Air Transport Service (MATS) moved personnel and materials across the Pacific Ocean. The two largest supply depots were at Clark AFB, PI, and FEAMCOM at Tachikawa Air Base (9:1). The supplies were distributed

throughout Japan by rail, truck, and inter-island air transport. At the start of the war the MATS supported cargo operations in the Korea and Japan area. Three months after the Korean War began the FEAF Combat Cargo Command assumed the responsibility for airlift in Japan and between Japan and Korea. Intra-theatre water transportation was provided by the Military Sea Transport Service (MSTS). Other than limited airlift, supplies to Korea were usually shipped to the ports of Pusan or Inchon and then transported inland by train or truck as far as possible. Often, it was necessary to employ human bearers (Korean or United States military), or animals, to get supplies to the units needing them. This condition existed throughout the entire Korean War. The Army was given the responsibility for transportation over roads and railroads inside Korea and Japan, and it improved transportation facilities and capabilities as fast as it could. Given the conditions, it did a fine job.

Moving supplies to maintenance units was often difficult. The only two adequate ports, Pusan and Inchon, were unable to provide enough facilities to expedite resupply operations from sealoft. Since the ground transportation in Japan and Korea was under the control of the Army, their needs frequently came first. Also, supplies had lower airlift priorities than did Army personnel and combat equipment required at forward areas (26:535).



Because Korea was a land of mountains, gorges, deep ravines, mud flats, marshes, and rice paddies, transportation through Korea was either very slow or non-existent. The vast majority of Korea's roads and railroads were developed during the country's occupation by China and Japan. There were only a few good highways, reaching only from one major city to the next. All other roads were nothing but mountain and dirt trails (26:60). The backbone of Korea's over-land transportation system was the railroads of which some 3500 miles had been built by the Japanese. On average during the war, thirty trains were used daily carrying supplies to forward areas, carrying troops, taking casualties back to the rear areas, and carrying supplies to supply depots. Each train consisted of 20 to 40 cars carrying 500 tons of supplies and 1000 troops (27:644). The well-constructed railroads usually followed the courses of rivers and valleys.

Neither North nor South Korea had many good seaports (26:61). Pusan, at the southern tip of the country had the best. The west coast was extensively mud flats with extremely high tides. The port at Inchon, which served the needs of Seoul, had a 27 foot tide and could only serve small vessels due to its tidal basin. Secondary west-coast ports had been developed primarily to serve fishing and agricultural interests. The majority of supplies used in Korea was transported by boat from the United States. High

priority items only were transported by airlift due to the high costs involved.

In South Korea the Japanese had built ten air fields, but fewer were in use in 1950 when the war began. Kimpo and Suwon were the only two airfields capable of handling high performance aircraft (26:61). The next best airfield was at Pusan. The lack of continued use allowed many of the other airfields to lay in disrepair. A small number of the airfields were in usable shape but could not handle the abuse of landings and takeoffs of the jet aircraft (26:61). All of the airfields had to be repaired and reinforced even to handle the propeller driven aircraft, and their heavy combat loads, with which the United States began its support of South Korea.

#### Scope of the Project

This research covered the time period from January 1950 to December 1953 in the area covered by the Far East Air Force. The research involved only FEAF's logistical actions during the Korean War. Since the effectiveness of aircraft maintenance can be attributed to various factors, only the areas of (1) supplying parts and materials for combat aircraft, (2) maintenance of aircraft used in combat during the war, (3) transportation of personnel and supplies, and (4) maintenance personnel were addressed. Each played an integral part in providing the material and services required for aircraft maintenance in Korea or Japan. Each

area was evaluated to determine its effects on aircraft maintenance and how it interrelated with the other three areas. The research also explored the effectiveness of maintenance techniques used during that period.

## II. Methodology

### Overview

The information for this research was obtained from literature reviews. The literature provided an accurate but sometimes incomplete historical description of the logistics situations the USAF aircraft maintenance efforts faced during the Korean War. Some time periods were covered extensively while others were only briefly examined. The literature was used to identify and evaluate the actions taken by the USAF relative to the accomplishment of aircraft maintenance.

### Justification of Method

Literature Searches. The majority of the information came from declassified reports and books. Since only partial information on any one subject was available, educated assumptions had to be made to piece information together in a logical order. The reports and books were obtained from the Air Force Historical Research Center, Maxwell AFB, and from the HQ AFLC Historical Branch, Wright-Patterson AFB. Background information on the war, and articles covering broad issues of the war, were obtained from library books, Defense Technical Information Center (DTIC) reports, and periodicals.

The research for this thesis was quite extensive. Many days were spent at the Air Force Historical Research Center,

Maxwell AFB, delving into command and unit histories from the Korean War. Very little specific information about aircraft maintenance at unit level during the war was found. No Air Force history of aircraft maintenance in the Korean War exists. A maintenance person wishing to know what happened to aircraft maintenance in that war, or what deficiencies existed, would have to spend weeks, perhaps months, digging through the documents so carefully retained in the Historical Research Center. And, then, that person would only know part of the events since so much was not recorded.

#### Investigative Questions

To guide the research effort, the following questions were posed. They were intentionally relatively broad questions to permit wide-ranging study. Answers to these questions concerning logistical support of aircraft maintenance during the Korean War provide insight to past combat maintenance problems and may also be used to evaluate the effectiveness of current logistical operations.

1. What were the effects of the military demobilization after World War II on supplying parts and personnel for Air Force maintenance needs when war erupted in Korea?
  - a. How can these effects highlight current problems or solve future logistical problems?

2. How did inadequate supplies impact maintenance effectiveness during the Korean War?
3. What were the aircraft maintenance capabilities of bases near areas of combat?
  - a. How did personnel policies, particularly tour length in Korea, effect maintenance capabilities?
4. What were the impacts on aircraft maintenance of REMCOs located in Japan?
5. What were the effects of transporting men, information, and materials from the ZI to Japan?
6. How did transportation techniques used to and from Korea, and in Korea, effect aircraft maintenance?
7. What were the training problems in maintenance and how did they effect aircraft maintenance?
8. What impact did civilians have on aircraft maintenance during the war?

### III. Literature Review

#### Development of Problems

Participants during the Korean conflict demonstrated a lack of knowledge of basic procedures that should have been committed to memory. The country apparently had gone to sleep after the second world war [31:3].

The logistical forces which supported combat forces in Korea were disadvantaged because of the lack of trained units, trained personnel, sufficient supplies, and proper facilities. The majority of the logistical problems could be attributed to forgetting the past. During the Korean War the armed forces were repeating similar mistakes of World War II (31:3). Some of the broad supply problems were; (1) needed supplies got lost on paper; they were in the theatre but could not be located or distributed; (2) supply items were not uniformly identified; and (3) the different services did not have a common language of supply. Two of the most prevalent maintenance problems throughout the Korean War were the lack of qualified maintenance personnel and shortages of aircraft spare parts.

Logistics support for units in Korea was sometimes difficult. The logistics "pipeline" from the ZI was over 6,000 miles long. Prior to the war, the time supplies would take from requisition form to delivery to the theatre was from 4 to 5 months (35:14). During the war, the time needed for the same process was reduced for most items, but the time reduced was dependent on the amount of supplies either

stockpiled or which could be manufactured in the ZI, the cost of shipping, and the shipping priorities to the Far East.

The long delays in receiving supplies plus the in-country lack of (1) good roads, (2) extended railway facilities, (3) navigable waterways, (4) efficient communication systems, and (5) useful airfields increased the magnitude of normal logistics problems. Delays often occurred due to required joint usage with the Army of theatre air transportation and the use of priority systems for shipments from the ZI to Japan.

Because the FEAF was a defensive force prior to the Korean War, it was not prepared to handle the logistics demands by its offensive forces when the war began. Spare parts for aircraft had been sufficient for peace time but when combat operations began spare parts supplies were rapidly depleted and flight operations had to be supported 'hand to mouth' (31:10). As soon as parts (wing tanks for F-86s or landing gear parts for F-51s, for example) arrived, they were quickly used up by the first organizations which could get to them. Long supply lines and continual distribution problems made logistics support difficult. Until 1952, the FEAF lacked proper organization to handle its logistics needs (31:10). For example, at the beginning of the war there were no engine overhaul facilities in the Far East theatre (9:8). Engines had to be sent to depot or



contractor maintenance facilities in the ZI causing considerable delays and additional costs.

At the end of World War II the hasty and unplanned demobilization caused enormous stock piles of materials to be abandoned at scattered locations throughout the Pacific. In many instances, excesses and surpluses could not be sold to the foreign governments where the supplies were stored because of the lack of dollars the foreign country wished to spend on the material. Huge quantities were abandoned on-site where last stored or used. Over-estimates of requirements during the war had increased the surplus left (31:13). Over-estimates had added 20 per cent to the total cost of the war.

Six months after World War II ended the surpluses overseas were not returned to the United States because the military (1) did not have estimates for future requirements, (2) there was little money for packaging and transporting the materials, (3) there was a diminishing demand for the property in the United States, and (4) there were no qualified people to identify and prepare it for shipment. In the Far East, bases and depots were deactivated and property and supplies sat idle to await disposition or refurbishing (13.3). The reclassifying, reclaiming, and returning to inventory of these leftover supplies from many World War II sites bridged the logistical gap at the beginning of the Korean war. FEAF organizations were short

of fuel servicing units for jet aircraft. Air units had to use World War II vintage units which had gone through depot maintenance 2 or 3 times in order to keep them operable and to alter them for jet fuel use, when necessary (35:43).

In Korea, excess stocks and simultaneous critical shortages were not uncommon (31:13). The problems of shortages existed because the United States had no forces in Korea until after Japan surrendered so there was very little World War II surplus in the country. Shortages occurred because of poor forecasting of future requirements, the absence of logistics plans for a conflict in Korea, and the higher priority commitment of USAF supplies to the European theatre. Some shortages reduced the capabilities of combat missions and in some instances prevented them. Surpluses of supplies not needed filled warehouses and increased handling costs. They occurred because commanders, fearful of not getting enough supplies for their organizations, again overestimated requirements. At the beginning of the war, and for many months after, there was no accurate forecasting for USAF logistical needs and there were not enough experienced logistics personnel to do the job correctly.

Air Force officials in Korea and Japan were dissatisfied with the procedures for resupply to overseas theatres (31:15). Problems arose because the procedures were not able to handle requests on a controlled and routine basis and personnel doing the supply work were untrained.

Lack of United States industrial base manufacturing capabilities to produce needed items compounded the supply problems. The USAF had difficulty requisitioning common supplies from Army depots. The Army had the duty of supplying all items in Korea which were common to the Army and the Air Force. Clothing, jeeps, trucks, building materials, and some petroleum products were some of the items which the Army had control over. Acquiring common supplies from the depots in the ZI was said to be easier than to requisition them from the Army (31:16). The Army sometimes refused Air Force requests because of the way the Air Force units requisitioned their supplies. Another problem was the difference between Army and Air Force supply procedures. For example, when supplies arrived at an Army supply point the using unit had to pick up its own supplies. Air Force units were accustomed to having supplies delivered to them (18:10).

The FEAF had to place its requirements for rail support in Korea and Japan with the Army. The Army determined the manner in which available rail car space could be used (31:17). There was no high level authority to determine railway space requirements or to assign priorities. Therefore, the departure of USAF supplies from Korean ports to inland destinations was often delayed (17:117). Inter-service priority boards were only used for air transportation. The Air Force was dependent on the Army for

its in-country surface transportation, via truck or railroads (9:22). While the 8th Supply Squadron was being airlifted out of Pyongyang, its supplies and equipment stayed in a rail station in Seoul for several days getting bombed because the supplies had no priority for movement.

FEAF units were not always allowed the cargo space they requested for intra-theatre water transportation (31:17). The Air Force had to rely on non-Air Force units (either Army personnel or indigenous labor) for seaport loading and unloading which often resulted in further delays and losses (31:18). For example, the local workers were not fluent in English so it was easy to understand how vital supplies ended up lost or mistreated. Also, since the Army had the responsibility for loading and unloading supplies from ships and aircraft, Army needs routinely took priority over USAF needs.

There were considerable personnel problems during the war. FEAF was only manned at approximately 80% of its authorized peace-time strength (18:8). Sometimes one career field was fully manned while another was critically short. Many airmen were not adequately skilled and this added to the problem. Maintenance personnel who had been trained on the F-51s were put to work on F-84s, which slowed down the turnaround times for servicing the aircraft. Some units just had the simple need for more personnel. During December, 1950, for example, the 3rd Maintenance Squadron had

a considerable shortage of airmen, 109 assigned out of 158 authorized. The squadron had to work 24-hour days with three shifts working seven days a week (20:111). In many of the sections, personnel did not get a day off for 10 to 15 days at a time.

• Serious maintenance problems arose from the lack of adequate numbers of experienced and properly trained personnel. Many airman were in Korea or Japan on their first enlistment and working on equipment for which they were not trained and with which they were unfamiliar (18:8). The highly experienced maintenance personnel had left the service after World War II because they did not want a military career or they were lured away by industry offering higher pay and better benefits (37:141). Accelerated personnel rotation schedules, created by the 12 month tour-of-duty in Korea, added to the manpower problems. By the time the personnel were familiar with, and skilled enough to work productively with, the equipment, they were rotated out of the theatre. Further, there was a shortage of personnel for low skill tasks, so more highly-qualified personnel from units in Japan and Korea had to fill the vacancies and perform the low skill tasks. This further depleted the manpower assets of the units and reduced unit logistics capabilities.

The increased complexity of the new aircraft and equipment introduced into the war caused problems because

maintenance personnel now faced additional training needs to become fully qualified in their maintenance fields for this new equipment (18:11). The training had to come in the form of on-the-job training (OJT) which slowed maintenance performance. At this time, too, aircraft performance was given the greatest amount of consideration in acquisition and aircraft designers were more concerned with the performance (speed and handling at high altitudes) and less concerned with maintenance, reliability, and support of the aircraft. Parts and assemblies became unservicable sooner than expected because they were not designed to handle the wear and tear of Korean runways and in combat. For example, the F-84 spent 66 hours in the repair shop for every one hour of flight during its first year (37:143). Special tool kits and technical orders needed to service the new aircraft were often not sent with the aircraft when it arrived on station. The tools already available at most bases were often useless for repairing the new aircraft. Equipment used to electrically start the new jet aircraft, and oxygen masks for the pilots, were just two of the items which often had to be reordered.

At the start of the war, Korean air base facilities were in poor condition. Air base facilities were generally primitive. Most of the air fields had been built by the Japanese and the majority had been abandoned for some time. There were very few buildings on the bases. Usually a base

might have two small hanger-type buildings which would be used as supply warehouses. The absence of adequate warehouse facilities caused considerable problems because materials stored outside were easily susceptible to theft and destruction by the elements of a harsh climate. Workshops and quarters buildings usually did not exist on a base (18:7). Tents were employed for those needs.

The efficient performance of aircraft maintenance was often hampered by bad weather (9:17). In the wintertime, some maintenance personnel worked in hangers or tents with interior temperatures well below freezing. The cold working conditions sometimes forced maintenance personnel to only perform minimal pre-flight and post-flight inspections, and replacement of failed parts. This inadequate maintenance helped promote the deterioration of aircraft sooner than expected. Utilities at most of the bases were very limited. Electrical power was not always available and when it was it was often unreliable. The 3rd Motor Vehicle Squadron in Korea was once unable to properly service vehicles at night because of the lack of electricity for lights.

Conventional aircraft at the beginning of the war were able to use only a few of the runways available in Korea. When the new jet aircraft were brought into the theatre the runways had to be rebuilt because the aircraft could not take the punishment of the rough surface and the runways were being destroyed by the small wheels and increased tire

pressures of the jet aircraft. The tire pressures increased from 80 pounds per square inch, during World War II, to 200 pounds per square inch. The jet blasts from the engines also tended to tear up the runways. The most successful surface used in the construction of runways was a half inch of asphalt pavement under pierced steel planking. Even with the construction of the new runways, tires and landing gear assemblies deteriorated faster than expected because the quality of the construction work and the conditions of the Korean soil were nowhere near the conditions of runways in the United States.

There were numerous problems with the construction of airfields in Korea. Due to the limited number of usable airfields, the Air Force ended up building more than 45 airfields in Korea over the course of the war (36:229). Several factors contributed to the construction problems: (1) bulldozers, cranes, and motorized graders were often unattainable or the ones which were available required constant maintenance and replacement of parts, (2) equipment and construction materials were often stolen while sitting at ports awaiting transportation, (3) the extremely high water table caused the ground to be waterlogged just a few feet below the surface causing equipment to get stuck in the mud, and (4) the lack of trained personnel needed to operate the equipment. Local labor and native contractors had to be used in place of the heavy machinery. This, plus the extra



5000 feet of runway required for jet aircraft more than doubled the time required to build the runways.

Petroleum, oil, and lubricant (POL) storage and distribution facilities were usually non-existent and had to be constructed to support the wing operations or units had to rely on storage in 55-gallon barrels or railroad tank cars. The storage of POL products in barrels in Korea caused a shortage of them in Japan. In some instances, sorties had to be delayed because the units did not have the storage facilities and had to wait for new shipments of fuel from Japan.

Supply support for aircraft in Korea also presented some problems for maintenance. Provisioning of spare parts had been done on the basis of peace-time usage. In combat the supply of spares was either inadequate or non-existent (18:10). During December 1950 the FEAF had to ground 34 of 94 C-119 aircraft assigned to it because of a lack of spare parts. Landing gears were used at abnormal rates due to the poor runways and larger and heavier than expected weapons loading of aircraft. Many jet aircraft were grounded longer than expected because of the lack of spares. Another major source of Aircraft Out-of-Commission for Parts (AOCP) arose every time a new series of aircraft arrived in Korea because adequate supplies of parts, and the pertinent parts lists, were seldom shipped with the aircraft (18:10). Shortages of ground support equipment (such as cranes and portable

generators) also adversely affected the maintenance capabilities of the units in Korea. The correct tools and maintenance ground equipment needed for aircraft service and repair were sometimes not available (18:11). Old equipment used during World War II and before was used at many repair facilities (1:3).

The problem of not enough spare parts was partly bypassed by cannibalization using parts from aircraft already AOCP. This procedure doubled maintenance man-hours and increased the AOCP rate because of the additional need for more spare parts and the long supply wait which often exceeded 90 days (18:11). Cannibalization also reduced overall reliability of the components and systems because of damages caused by the excessive removal and replacement of parts. The Fifth Air Force advised its units against cannibalization until all local means of replacement were exhausted. Engine parts and landing gear assemblies were two of the most common cannibalizations.

Corrosion of replacement fighter aircraft shipped from the ZI posed a major problem. Large numbers of aircraft were shipped on the decks of petroleum tankers and freighters, and on the hangar decks of aircraft carriers, due to other water transportation shortages (17:115). The aircraft shipped by tanker and freighter were subjected to extreme corrosion because the aircraft traveled to Japan on open decks. The salt mist damaged unpainted surfaces even

though the aircraft had been "cocooned", which meant it had been preserved for storage or transportation.

There were other corrosion problems, as well. Weapons firing in flight created clouds of highly corrosive gas which seeped into the aircraft skin joints and began to eat at the basic metal. The seriousness of this problem was not immediately recognized and cleansing efforts following flight were not at first adequate. As the extensive corrosion damage from the gases began to be noted, and extensive repairs were found necessary, careful cleaning following combat firing was accomplished as soon as weather conditions permitted. Nevertheless, corrosion became, and stayed, a major problem.

Dust, too, became a problem. The hot and dry Korean summer, often accompanied with high winds, was a source of blowing sand or surface dirt. This material acted somewhat like sandpaper destroying the surface of windshields and the protective surfaces of metal fuselages and wings. Fuel and oil leaks were continuous and their residue served as magnets for the blowing, grainy dirt. Thus, the aircraft surfaces were often coated with this erosive pasty material which created severe problems for moving surfaces as they ground themselves to destruction.

In the winter, and in the rainy seasons, moisture added to the corrosion and dirt problems because cleansing was relatively impossible. There were no facilities on the

Korean air bases which would permit aircraft washing under cover during the first year, and more, of the war. So, when it rained, or fell below freezing, maintenance personnel could not clean the aircraft following flight, or periodically, and the extensive corrosion did its further damage which the REMCOs later did not have time to remedy. Ultimately, the aircraft required long-term maintenance to correct the corrosion damages and the unit lost a combat aircraft for a long major maintenance period.

The failure of senior officers to realize the need for coordination between the operational and support units led to aircraft being down for maintenance longer than needed (18:11). For example, maintenance and operational units at wing and lower levels had trouble coordinating their mission requirements and aircraft maintenance scheduling requirements. This coordination problem was especially true in REMCO units because distance increased the need for communication between the tactical and maintenance units with essential schedule and maintenance information. Maximum unit readiness was regarded as the wing's top priority, but maintenance needed to care for the aircraft was not given such high priority. Commanders seemed not to realize that their aircraft, equipment, and squadrons could only operate at good efficiency for limited periods without proper maintenance and care (18:11). During the early stages of the war there was a rise in the number of non-

effective sorties; missions in which the aircraft was unable to perform its assigned task. This rise was linked to the lack of adherence to proper maintenance schedules. For example, some commanders in Korea did not stress the importance of performing 100-hour maintenance inspections, which could have been performed at REMCOs in Japan (9:16). The extended time past the inspection period created a reduction in combat effectiveness.

#### Local Actions and Policies

Aircraft maintenance activities in Korea consisted of organizational and field maintenance on propeller-driven and jet aircraft. Technical assistance was given to combat units in Korea, and to REMCOs in Japan, by 116 civilian technical representatives who worked for 25 manufacturers (17:114). Some of the major companies providing critical assistance for Fifth Air Force units in Korea were Boeing, Lockheed, and Pratt & Whitney. Wings stationed in Korea were responsible for the organizational and field maintenance of their aircraft. Depot maintenance, and supply distribution, was performed by depots in Japan. Approximately a year after the start of the war some of the field and organizational maintenance manpower and equipment was transferred from Korea to the REMCOs in Japan.

Technical representatives from aircraft and system contractors provided technical assistance which was not otherwise available from USAF personnel because maintenance

position vacancies were not filled with experienced maintenance personnel. Technical representatives were personnel who represented a manufacturer of USAF equipment. They were employees of the manufacturer assigned to the Air Force under contract for duty (11:1). They provided advisory service for the installation, modification, and operation of the manufacturer's equipment. They assisted maintenance activities in training, kept up-to-date information on supply matters which effected maintenance, and offered advisory services. The support given by the technical representative often took the form of on-the-job training which increased the skill levels of USAF personnel responsible for the operation and maintenance of the equipment (11:3).

For example, the Fairchild Aircraft Company sent technical representatives to Korea at the beginning of the war to help maintain and modify the C-119 aircraft (11:121). Major problems solved during the beginning of the war were with the propeller, nacelle, and booms. Some of the modifications to the C-119 aircraft were to increase the propeller blade's angle of attack which allowed the aircraft to maintain altitude better, and to design a nacelle structure reinforcement kit which stopped the numerous nacelle failures the C-119 was experiencing. Technical representative skills were crucial to the resulting

successful modifications of the C-119 aircraft which improved its combat utility.

During the first year of the war the UN ground units were constantly moving due to the effective combat efforts of the North Korean forces. The combat area was in a continuous state of change. Korean air bases under USAF control one day would be lost on another. Considerable equipment, and materials, was lost to the North Koreans when they captured our air bases. Units deployed in Korea had to be prepared to move at a moment's notice. Unit mobility was extremely difficult when an entire wing with supporting equipment and personnel had to move quickly with minimal transport support to avoid capture.

Of the approximately 10,000 measured tons of tools, supplies, and equipment carried by fighter and light bomber wings, it was necessary to keep about 80 per cent boxed in readiness to move immediately should the situation demand it [16:2].

This was the primary reasoning behind the initiation of the REMCOs in Japan.

The transfer of large numbers of maintenance technicians and many tons of large and expensive equipment from the combat wing in a Korean combat arena to a REMCO in Japan greatly enhanced the mobility of the wings. Therefore, it became much easier for the wings to move if the aggressive communist forces made that necessary. The reduction in the number of people and quantities of equipment gave the combat units more mobility yet still

allowed adequate maintenance capabilities to keep the unit aircraft ready for combat. The only maintenance personnel and equipment retained with the tactical unit in combat in Korea were those needed to accomplish organizational maintenance keeping the aircraft in operational, combat ready, condition. All else was done by flying the aircraft to Japan where the REMCO could meet the requirement. The skills of maintenance personnel at REMCOs and at the bases in Korea were similar. The differences in the two were determined by the amount and type of equipment used in the two areas, the desires of the wing commander, and the amount of personnel trained in the different area. The different skills usually found at the REMCOs were: (1) aircraft & engine, (2) engine, (3) electrical, (4) aircraft inspection, (5) flight test, (6) instrumentation, (7) propeller, (8) hydraulics (wheels and brakes), (9) paint, dope, and fabric, (10) armament, (11) photo, (12) sheet metal, and (13) fabrication which included welding, woodworking, and communications.

On-the-job training proved important to the maintenance performed in Korea. The majority of first term maintenance airmen assigned to USAF units were either inadequately trained on the aircraft to which they were assigned or they were assigned to a unit with aircraft for which they were not trained at all (13:32). Technical representatives and more experienced maintenance personnel provided OJT which



was the best training technique for the new maintenance personnel in a combat area. OJT was a considerable benefit when used in conjunction with USAF technical manuals and procedures. When the maintenance personnel were at last becoming proficient, the unit would lose them because it would be the end of their twelve month Korean tour-of-duty and time for them to return to either Japan or the United States. Such was the cost of the twelve month tour-of-duty.

Nearly all maintenance units in Korea found they had to have OJT programs to familiarize or update personnel with maintenance technical orders and new equipment. They provided OJT in the stress of a combat area and under the strain of the variable, often severe, Korean environmental conditions. They were successful, on the whole, but they should not have been forced to do this. It should be noted, OJT and unit training should not be the planned method for qualifying maintenance technicians in future combat areas. Air Force units introduced to combat should be assigned trained and qualified maintenance personnel even if it must be at the expense of other units in the United States or other non-combat areas.

#### Theatre Actions and Policies

The two major supporters of aircraft maintenance in the theatre of operations were the Fifth Air Force and the FEAMCOM. The Fifth Air Force conducted the majority of air operations over Korea, supported its units' organizational

and field maintenance, and directed the REMCO organizations. The Fifth Air Force was also assigned the task of operating and maintaining the bases in Korea. The FEAMCOM was given the duty of providing logistics support for all FEAF units.

Due to poor working conditions, inadequate facilities, the fluidity of the combat environment, bad weather, and not being able to obtain permanent base facilities, some wings stationed in Korea divided their maintenance and supply organizations into two sections. The majority of maintenance equipment and personnel set up in Japan while the tactical portion of the wing and enough maintenance personnel to keep the wing's aircraft in the air remained in Korea. Different wings flying the same type of aircraft combined their maintenance and supply personnel and facilities to create the rear area maintenance units called REMCOs (29:4). Maintenance operations in Korea were then limited to flightline maintenance activities such as pre-flight and post-flight inspections, refueling, rearming, changing failed components, light repairs, and 50-hour inspections. All other organizational and field maintenance was accomplished by the units' maintenance personnel at the REMCO facilities in Japan. The 51st and the 4th Fighter Interceptor Wings plus the 8th and 18th Fighter Bomber Wings set up F-86 REMCOs in Tsuiki, Japan. The 58th and the 49th Fighter Bomber Wings set up an F-84 REMCO in Itazuke, Japan.

At the start of the war two FEAMCOM air depot wings in Japan provided the depot maintenance for aircraft used in Korea. Whenever aircraft were due for DIR (Disassemble, Inspect, and Repair), or when the aircraft could not be serviced at the operational wing level, the aircraft in Korea were sent to Japan for depot maintenance. The depot shops performed major maintenance and inspections including the replacement of engines, major component repair, and the accomplishment of USAF-directed modifications of the aircraft.

The two depots ordered supplies from the ZI for maintenance and supply units in Korea from written requisitions and oral requests from supply officers in the units. The depots in Japan would send the order for Air Force peculiar supplies through FEAMCOM to the Sacramento Air Materiel Area (AMA) depot in the ZI. The supplies would be transported by ship or air from the ZI back to the FEAMCOM for further distribution to the requisitioning organization. Supplies which were common to both the Army and Air Force units (building materials, clothing, POL products) were ordered through the Army's Japan Logistical Command (JLCOM) (9:6). Air Force units in Korea sent requests through Fifth Air Force channels to the JLCOM which would then send the requests, plus the Army's supply requests, to ZI. Large requirements for items that were not immediately available from the ZI and which could provide

substantial savings to the Air Force were provided by Japanese industry. Aircraft belly tanks and tools kits were just two of the items ordered through contracts with the Japanese manufacturers.

Materiel coming to and going out of the Far East theatre was transported by airlift and ships, but less than 1% of the supplies for Korea moved by air (27:21). Materiel which was moved by ships first came to the port of Yokohama, Japan. From there it was transported to the using unit and depot locations throughout Japan or was reloaded on intra-theatre ships bound for Korea. The MSTS provided intra-theatre sealift for Army, Navy, and Air Force needs. The MSTS consisted of government-owned Navy vessels and Japanese commercial carriers. The JLCOM (Army) controlled all the surface transportation through port authorities in Japan and Korea. Surface shipping space available for use by Army and Air Force units was allocated by the JLCOM. But, since all three of the military services were involved in Korean operations, final transportation arrangements had to be made through working agreements with the different services.

At Yokohama Port, personnel or cargo for water transportation was booked by the base transportation officer (Army) with the port authority, who notified the consignor (Air Force officer needing materials transported) of the shipping date. The consignor was then told how much space was expected available for Air Force needs during the time

requested. At other ports, shipments were made on a "first come, first serve" basis because of the limited transportation available (9:22). There was no joint service board to determine waterlift priorities.

Three organizations controlled the airlift of personnel and materiel into and in the theatre. They were the MATS, the civilian contracted Civil Air Transport (CAT), and the Combat Cargo Command. The Fifth Air Force also provided some airlift but it was mostly for its own use. The MATS and CAT provided airlift to and from the ZI and Japan. During the first few months of the war, CAT also had responsibilities for cargo and personnel transportation in the theatre. Soon after the beginning of the war the FEAF Combat Cargo Command took over for CAT and was used for intra-theatre cargo and personnel airlift. The Combat Cargo Command consisted of C-46, C-47, C-54, C-119, and C-124 aircraft. During this time MATS still provided some intra-theatre cargo airlift but was mostly used for passenger and mail airlift in the theatre. CAT was later phased-out of transportation to and from the Korea.

The space available for the different services for airlift operations was determined by a Theater Air Transportation Board (13:26). Since there was usually not enough airlift available to meet the needs of all the services at the same time, the board was established under the Far East commander. The board was composed of Army,

Navy, and Air Force representatives. Each was responsible for representing his service's needs and at the same time considering the competing requirements from the other services. Prior to the war, requests for air transportation from Japan and the ZI were assigned through channels to the FEAF, where a priority was made for the transportation. Air transportation in Japan was controlled by the FEAMCOM but after the war began, airlift was controlled by the FEAF. Airlift to and from Korea had to be cleared through the FEAF.

#### Far East Air Materiel Command Actions and Policies

Supply and maintenance support of the FEAF was the major responsibility of the FEAMCOM. Its mission was to (1) exercise command over all units assigned including air depot wings, maintenance and supply groups, and materiel control groups; (2) provide adequate logistics support to all Air Force activities in the Far East; and (3) provide specific logistics support, in conformance with fixed agreements, to other United States forces. Its depots were focal points for all supplies, personnel, and aircraft arriving under the jurisdiction of the FEAF (13:1). The distribution of thousands of items, thousands of tons of supplies, was one of its main missions. All of the supplies from the ZI used by the FEAF were received and distributed by the FEAMCOM. Besides controlling supplies, a major responsibility of the FEAMCOM was the operation of maintenance depots in Japan and

the PI. Some of its specific responsibilities were to (1) exercise technical supervision and control of procurement for all the FEAF activities; (2) maintain, overhaul, repair, and modify all material for which the FEAF had responsibility; (3) perform the functions of the central procurement agency for the FEAF; and (4) determine and prescribe logistical policies and central procedures for the theatre.

The FEAMCOM had considerable control over nearly all aspects of maintenance. Besides monitoring maintenance programs in the theatre, it defined and interpreted maintenance policies and procedures for organizational, field, and depot maintenance. It controlled the theatre-wide scheduling of aircraft into depots and contractor facilities and the scheduling of aircraft for return to the ZI. It maintained close watch over maintenance throughout the theatre by field visits to assist or advise on maintenance problems. The FEAMCOM reviewed technical orders and publications to insure they were consistent with theatre policies. During the war, the FEAMCOM, the AMC, and the FEAF met often to correct materiel and design failures of USAF equipment. The modifications to the C-119 aircraft's propellers and engines were just two results of the coordination.

The mission of the AMC during the war was to provide the materiel for USAF units in the theatre through the

FEAMCOM, supply technical support to Far East maintenance and supply problems, and provide trained support personnel to the depots in Japan and the Philippines. When the FEAMCOM needed supplies or parts it had only two major channels to obtain them, manufacturers in the theatre (mostly Japanese) and the AMC. Throughout the war the FEAMCOM requested materiel from the AMC, which would in turn obtain it from sources in the ZI. The AMC often provided technical assistance to the FEAMCOM as it did in aiding in the modifications of the C-119 aircraft. To provide properly trained personnel to support maintenance in the ZI and overseas, the AMC directed programs for training supply, maintenance, transportation, procurement, and other depot personnel. The AMC supply programs assisted personnel to perform the operations of receiving, shipping, storing, preservation, and issue (6:4). The AMC provided trained personnel to the depots in the Far East.

Organizational and field maintenance was performed under the direct control of the Fifth Air Force wing commanders in Korea and in the REMCOs in Japan. Depot maintenance in the Far East theatre was performed by air depot wings under the control of the FEAF commander who delegated this responsibility to the FEAMCOM. Depot maintenance in the ZI was under the control of the AMC commander.



Air depots in the ZI were the engineering, overhaul, supply, and information centers. "One depot might be responsible for supply and maintenance support for 15 or 20 wings within its geographical area" (2:38). After aircraft had flown a certain amount of time, or when the aircraft was damaged beyond the capabilities of field maintenance facilities, it was sent to a depot or to a civilian contract facility. The depots in the ZI performed the same kinds of maintenance as the depot wings in Japan including overhaul of the aircraft components, accomplishing directed modifications, and executing Inspect and Repair as Necessary (IRAN) activities to aircraft. A common operation which took place when an aircraft first arrived was a Depot Inspection and Repair (DeIR) (2:39). The DeIR consisted of the removal of engines, accessories, and control surfaces. New or refurbished engines, accessories, and control surfaces were installed on the aircraft after the inspection was completed. Cracks, loose fittings, and other faults discovered were scheduled for repair during the inspection.

Another important feature of the air depots in the ZI and the air depot wings in Japan was technical advice and assistance. If a squadron was having engine maintenance trouble, or was concerned about new modifications to an aircraft which could not be accomplished at the wing level, engine specialists, technical representatives from the ZI, or additional technical information were sent to the

squadron. This was exactly what was done in Japan when the C-119 aircraft was having all of its problems. Technical assistance was very effective, very helpful, and greatly appreciated by the operational units.

The depot system in the ZI was organized in a two zone system at the time of the war: an eastern and a western zone. The zones were separated by the Mississippi River. Each zone was divided into geographical areas called Air Materiel Areas (AMAs), three eastern and five western. The AMA depot and headquarters for each AMA in the eastern zone were located in Middletown, Pa.; Macon, Ga.; and Mobile, Ala. In the western zone they were located in Ogden, Utah; Oklahoma City, Okla.; San Antonio, Tx.; Sacramento, Calif.; and San Bernardino, Calif. Each AMA was a depot responsible for all maintenance and supply support for all Air Force activities in its area. But, also, each AMA was specialized by being responsible for maintaining only specific types of aircraft and equipment. No two AMA depots in the same zone were responsible for the same aircraft. Each of the two zones was self-sufficient for its own maintenance and supply needs. For every type of aircraft or piece of equipment used in the zone, one depot in the same zone was able to service it. One zone was capable of performing the same activities as the other. The two zone organization was implemented to reduce the large-scale duplication of effort earlier occurring at the AMAs (2:40).

The FEAMCOM depots did not operate independently of the AMAs in the ZI. If there was work which could not be completed by a FEAMCOM depot, the work was sent to an overseas control depot. Jobs from Japan were sent to the Sacramento AMA depot. At the control depot the work would be sent to the AMA responsible for the particular types of aircraft or equipment in the ZI. After the work was complete, the aircraft or equipment would be sent back through the control depot and then on to the overseas depot (2:43). Also, supplies from the ZI were sent through the Sacramento AMA to the FEAMCOM depot. Following a meeting in July 1950, representatives from the FEAMCOM, the FEAF Deputy of Materiel, and the AMC participated in a teleconference for the purpose of requisitioning supplies from the ZI. One of the decisions made during the meeting was that the FEAMCOM would serve as the central stock control agency for the Air Force in the FEC. Accountability of supplies sent from the ZI was one of the important points brought out in the conference.

#### USAF Actions and Policies

During the Korean War the United States military forces were under the command of the FEC. General of the Army Douglas MacArthur was the Commander in Chief of the FEC (CINCFE) at the beginning of the war. Under the FEC were the three major military services; Air Force, Army, and Navy. Overall strategic and tactical plans were jointly

developed at FEC HQ in Japan by the leaders of the three services (15:80). The Army contingent of the FEC consisted of the Eighth Army and the X Corps which reported directly to CINCFE. The CINCFE was given unified command over all forces allotted to him by the Joint Chiefs of Staff. The naval forces allocated to the FEC during the war were the United States Pacific Fleet, Pearl Harbor, operating as the United States Seventh Fleet. The USAF elements of the FEC were assigned to a theatre command, the FEAF. The theatre organization consisted of a major headquarters for the Navy and the Air Force, but no major subordinate Army headquarters existed. The Commanding General (CG) of the Eighth Army was on the same command level as the CG, Fifth Air Force, and the Commander, Seventh Fleet. In August 1950 the X Corps was activated in Korea on the same command level as the Eighth Army.

After deployment of the Eighth Army in Korea in July 1950, the newly created JLCOM took over for the Eighth Army. The JLCOM provided logistical support of items common to Air Force and Army units in Japan, while the Eighth Army provided logistical support to both the X Corps and the Fifth Air Force in Korea. The Eighth Army supported Air Force units with items common to both services.

Basic policies for the use of air power over Korea came from the CINCFE. The policies were developed by the General Staff, mostly Army, with consultations from HQ FEAF and

Commander Naval Forces, Far East (COMNAVFE). The CINCFE exercised his command authority over air operations over Korea through a device known as 'coordination control' (8:11). Coordination control was the authority to disapprove any operations of one force which might interfere with the operations of another force and to coordinate air efforts of the major FEC elements by such means as prescribing boundaries between operating areas and time of operations in the areas. Due to the close proximity of the different service headquarters, much of the coordination was made through personal contact between the major service commanders.

Some of the specific missions of the FEAF were to:

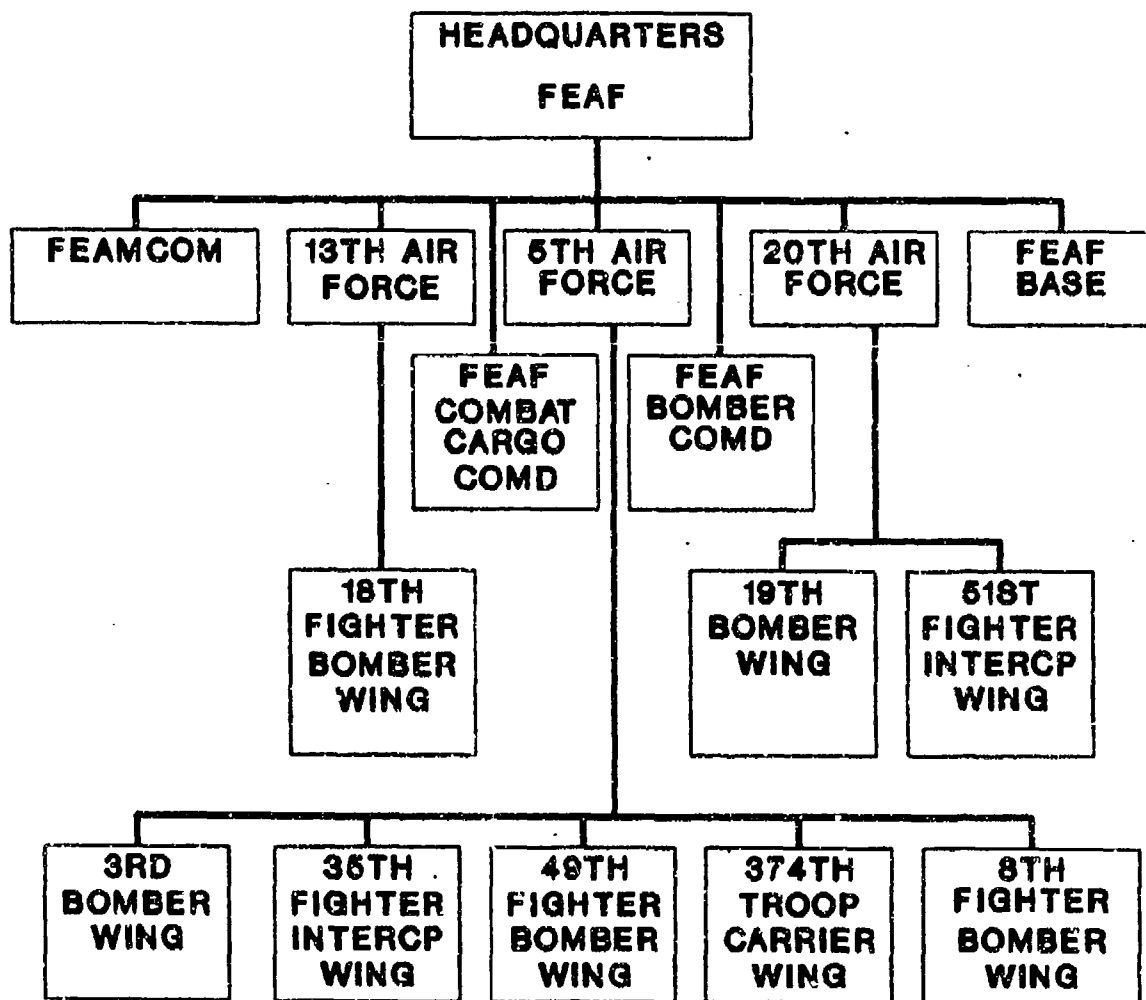
- (1) Maintain air control over Japan, preventing unauthorized aircraft entering the FEAF controlled areas.
- (2) Conduct air transport operations.
- (3) Maintain a sizable striking force as prescribed from time to time.
- (4) Maintain air bases and related installations, including staging bases and facilities for mounting air strikes.
- (5) Provide air defense for Japan, including air warning services, and providing the capability to shift to full alert status at a moment's notice.
- (6) Provide air support of operations as arranged with appropriate Army and Navy Commanders.
- (7) Conduct required troop carrier operations.
- (8) Establish and control military air routes, air traffic procedures and the facilities, in conjunction with the MATS, and appropriate naval commands.
- (9) Control international air traffic entering or departing Japan.

(10) Coordinate with the CINCFE proposed changes in Air Force programs which may result in future demands with Army logistics agencies.

It was not the responsibility of the FEAF commanding general to plan for the defense of Japan, the implementation of interdiction programs, or the support of ground forces (15:10). Those decisions and other policies at FEAF HQ were jointly made by the three services so no service was placed under a commander of another service (32:6).

The FEAF consisted of the Fifth Air Force, the FEAMCOM, the Thirteenth Air Force, the Twentieth Air Force, the FEAF Base, the FEAF Bomber Command, and the FEAF Combat Cargo Command. The Fifth Air Force, the FEAF Bomber Command, and the FEAF Combat Cargo Command conducted the majority of the air operations in Korea and Japan (15:80). The majority of the aircraft maintenance performed in Korea was in support of Fifth Air Force Units. Only a little maintenance support in Korea and Japan was provided by the Thirteenth and Twentieth Air Forces which had other missions and were not located in Korea or Japan. Organizational and field maintenance in Korea was provided by units under the operational wings of the Fifth Air Force, including the REMCO operations in Japan. The FEAMCOM provided the logistical support for the FEAF and operated the supply and maintenance depots in Japan, and temporary ones in Korea called Korean Air Materiel Units (discussed later).

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ORGANIZATION  
1 October 1950**



Coordination with the different services and HQ FEC in Tokyo was accomplished through personal contact among the major commanders, daily staff briefings, meetings with the Joint Strategic Plans and Operations Group and the other services, and the exchange of liaison officers.

At the start of the war, the FEAF had the responsibility for logistical support in Korea, Japan, and the Philippines for USAF technical supplies and equipment. The FEAF supported the SAC units deployed in the Far East and furnished some supplies to the Navy, Marines, MATS, and civil airlines (32:231). FEAMCOM supervised and coordinated all supply and maintenance activities in the command and controlled all technical aspects of supply and maintenance.

FEAMCOM was the operational logistics organization carrying out directives of higher headquarters and implementing policies passed to it by FEAF through the Deputy of Materiel [32:231].

The FEAF Deputy of Materiel provided technical advice and assistance to the FEAF commanding general and other FEAF staff members in all matters concerning the acquisition, development, construction, repair, preservation, use, and disposal of the FEAF real estate facilities and utilities services as well as aircraft maintenance and supply. The Deputy of Materiel insured that the FEAF objectives were being carried out. The Deputy of Materiel did not perform any maintenance but provided policies and plans for subordinate commands such as the FEAMCOM.



The USAF and the AMC supported the FEAF operations in Korea by giving the highest practical priority to existing unfilled FEAF requisitions on hand in the ZI and all incoming requisitions from the FEAF (32:234). The top priority and daily radio requisitioning reduced order and shipping time to a minimum. A system was set up between HQ USAF, the FEAF, and HQ AMC to expedite supply actions. The most important activity undertaken by the AMC was the procurement, assembly, and delivery of the supplies, spares, and tools which kept the FEAF flying (3:29). Supplies were shipped from the ZI daily by Marinex, fast water delivery, and by routine water transportation. Marinex was the code word for Marine Express water shipment. The average time for Marinex was 14 days, four less than routine water shipments.

At the beginning of the Korean War USAF had no choice but to equip the Fifth Air Force with mostly older-type aircraft since they were the only aircraft possessed in sufficient numbers for Korean activities. Not enough modern planes had been built to support both the European and Pacific theatres, including Korea. Also, USAF officials cited that the older, conventional aircraft were good enough to defeat the enemy's air operations and that the older aircraft could be better operated from the rough airfields in Korea (26:357). Months of combat from crude facilities, where maintenance was often rudimentary, began to exhaust

the supply of the F-51 and F-80 aircraft. This, plus the fact the new communist MIG-15 aircraft out-performed the older aircraft, did little to persuade USAF officials to quicken the pace of conversion of units to F-84 aircraft. The USAF did not want to disrupt the support of the North Atlantic Treaty Organization (NATO) air forces, and official thinking was that Korean hostilities would end by January 1952. Support for the repairing of Korean airfields and for the acquisition of new aircraft was difficult to obtain from USAF officials throughout the war (26:360).

#### IV. Problems Encountered and Corrective Actions

##### In-country

Adequate and timely aircraft maintenance involves four important ingredients regardless of operational conditions. Anything less than the minimum in the four ingredients will ultimately create some form of difficulty either for the operator or the maintenance personnel, or both. The four ingredients are : (1) Availability of the aircraft for the time required to perform the needed maintenance; (2) Knowledgeable and experienced technicians; (3) An adequate working area with required support equipment and tools; and (4) Sufficient spare parts to meet the needs of the maintenance to be accomplished. Deficiencies in any of the four may degrade the timeliness and quality of the maintenance and, further, may have severe impacts on flight safety and/or mission performance. During the Korean War, and most especially during the first 18 months of the war, the four ingredients for safe and proper aircraft maintenance were all deficient.

Aircraft were often flown beyond the scheduled maintenance point. Mission needs, and the shortage of available aircraft, required flight schedules which made maintenance considerations take second place. Many times, then, the aircraft developed additional requirements when released for maintenance which added to the time required

for corrective action and kept the aircraft out of mission schedules for longer periods.

At the start of the war the USAF had not recovered from the massive demobilization following World War II. Experienced maintenance personnel were in short supply in USAF units world-wide. USAF policy for assignment of personnel did not give priority or special consideration to Korean assignments. Therefore, knowledgeable and qualified maintenance personnel were always a scarce commodity. Training and qualification of maintenance personnel established an additional burden on the units in a combat area and decreased their abilities to meet mission needs.

Because many of the names of the cities and towns in Korea were very similar in spelling and many had several names, the FEAF in July 1950 assigned "K-site" numbers to each airfield in Korea for the purpose of exact identification. Some of the most important sites in Korea were labeled as follows:

K-site #	Korean city
K-1	Pusan West
K-2	Taegu
K-3	Ponhang
K-5	Taejon
K-8	Kunsan
K-9	Pusan East
K-10	Chinhae
K-13	Suwon
K-14	Kimpo
K-16	Seoul
K-24	Pyongyang East

This identification system lasted throughout the Korean War.

In 1950 and 1951, the airfields of Korea were in pretty poor condition. They were what remained of poorly maintained Japanese airfields of World War II. They had poorly surfaced runways and taxiways which were generally inadequate for jet aircraft and heavily loaded propeller-driven combat aircraft. There were few buildings and the limited number of small hanger-type buildings were regularly used for supply storage because of the absence of other interior storage facilities. Shop buildings, and aircraft maintenance shelters, were non-existent. Roadway, communication, and POL supply facilities were not available.

To overcome these bare-bones conditions, tents were often employed for quarters, for messing and medical facilities, and for maintenance support. The early days of the war found the UN forces in highly fluid conditions as the communists charged southward. Many times, the air bases had to be abandoned because the territory was being taken over by the invading forces. Much equipment and maintenance support tooling was lost in that manner and the losses were not replaced for months. For example, In December 1950 the 8th Maintenance Squadron evacuated the city of Pyongyang because of advances of the communists. Prior to leaving, the Aero Repair Section worked day and night making three F-51s flyable. Remaining aircraft had to be destroyed to prevent them from being captured by the enemy (20:125). After the squadron arrived in Seoul it set up maintenance

shops using squad tents as shelters. After seven days the squadron was evacuated again, this time to Itazuke, Japan. Then, when the UN forces resumed the offensive and forced the communists to fall back to the North, the airfields again became available. But, they had not been improved in their short-term occupation by the communists and the conditions were still unsatisfactory for quality maintenance.

No one in the FEAF had anticipated a geographically constrained conventional war in the Far East. So, no plans existed for meeting the needs of the Korean War when it began. Spare parts on-hand throughout FEAF were based on forecasts for a relatively small number of aircraft, propellor-driven, to be used in defensive actions. The parts were far from adequate to meet the needs of increased offensive combat sorties and flying hours and the needs coming from greatly increased stressing of aircraft systems with combat loadings.

Shortly after the war began, the USAF moved some jet aircraft into combat in Korea. No planning had been accomplished for these aircraft in the theatre and parts began, and continued, to be a major deterrent to maintenance. Jet aircraft had not been used in the previous war by United States forces so we had no combat experience to employ in computing jet aircraft spare requirements in actual warfare. Thus, the supply system was faced with an

unknown usage condition coupled with inadequate planning, as well. This condition improved, of course, as the war continued.

Aircraft supplies were frequently delayed because they did not at first receive adequate priority for movement by air or water. The Army controlled shipping allocations for sealift and routinely gave priority to ground combat forces and their gear at first. By the time this was rectified, the war had been in action for over a year. Parts rarely moved by air because they weighed too much, cost too much to move through this form of transportation, and because priority was given by a joint service allocation board to other commodities and to personnel. The problem remained throughout the war.

Maintenance. Aircraft used in operations in Korea were maintained in one or a combination of four areas; K-sites in Korea, REMCOs in Japan, depots in Japan, or depots in the ZI (REMCOs and depots will be discussed later). The mission of the aircraft, the local situation (facilities and transportation routes), and the desires of the wing commander determined the organization of the combat wing and how the aircraft were to be repaired and maintained. At the beginning of the war, the variations of the organizations could be grouped into four categories: (1) the entire wing moved as one unit, (2) the tactical group and minimum support units went forward, keeping the rest in the rear,

(3) the majority of the wing moved forward, leaving aircraft maintenance to the rear as a tenant organization, and (4) the entire wing was moved forward but a "sub-depot" was established to the rear for aircraft maintenance support with variations to the last three categories. The housekeeping overhead was reduced when several rear maintenance units were grouped at the same base, and supply problems were minimized by assembling the same type of aircraft. This was the first beginnings of the REMCOs.

The first category described wings which used the wing-base concept, performing all field and organizational maintenance at K-sites. An example of this category was the 49th Fighter Group which in July 1950 was equipped with F-80s. This group plus three other squadrons combined together with the 6149th Tactical Support Wing and moved to K-2 in Korea. Two small hangers already there were used as supply warehouses. Other buildings were erected and used for maintenance shelters. During the first winter, the only maintenance shelters were wind breaks without roofs. Winterized tents and stucco buildings were used as barracks. Due to the lack of facilities the maintenance activities consisted chiefly of refueling, rearming, and component replacement activities required to keep the aircraft operational. The operation of the first machine tools at K-2 occurred almost a year after the field was occupied



(18:15). Operational commitments were heavy and, as a result, the condition of the aircraft deteriorated. Large numbers of aircraft were reported lost due to unknown causes and materiel failures.

The second category was demonstrated by the 27th Fighter Escort Wing, which was on a nine month temporary duty to the theatre. Approximately 200 men were transferred to the Field Maintenance Squadron and the remainder to a provisional organizational maintenance squadron. The organizational squadron of approximately 106 men accomplished 50 hour (second intermediate inspections) and 100 hour (major inspections). The remainder of the personnel made up the tactical squadron, which accomplished daily and first and third intermediate inspections. Armament and communication maintenance was performed by the field maintenance squadron. The remaining aircraft and personnel of the wing were at Itazuke to provide for maintenance and training.

The 425th Light Bomber Wing was an example of the third category. It moved to K-9 but kept its aircraft maintenance at Miho, Japan. Working conditions in Korea were so unfavorable it was decided to accomplish aircraft inspections at Miho. The commanding officer of the maintenance and supply group supervised the operation at Miho. During November 1950, 342 maintenance personnel were located at Miho while 1714 other personnel were located at

K-9. The aircraft were scheduled for inspection by the tactical group headquarters to insure there was an even flow of work. Daily coordination was maintained between the tactical units and the maintenance and supply group. The time between when the aircraft left the field for maintenance at Miho and the time it returned to K-9 was about four days.

The movement of the entire wing and the troubles encountered were well illustrated by the 6131st, the 6150th, and the 6002nd Tactical Support Wings. These wings experienced high operational losses not directly due to battle damage. Only a few of the losses were due to weather or poor runway conditions. The majority of the losses were due to (1) the nonavailability of theatre stocks of spare parts, (2) the failure of equipment to catch up with the organizations when they moved, (3) the loss of equipment due to theft, transportation misrouting, and enemy action, and (4) the lack of equipment because the unit's equipment was delayed in transit because of higher priority items. A sub-depot maintenance operation established later by these wings at Tachikawa, Japan was an attempt to correct some of these problems.

This sub-depot organization was started in the middle of January 1951. Aircraft received from field organizations were given minor reconditioning, engine changes and parts replacement. Approximately 146 aircraft were given

shakedown inspections. The organization was discontinued in August and the manpower was absorbed by the 18th Fighter Wing which was the successor to the 6002nd Tactical Support Wing. Since this was a new kind of organization in Korea several problems occurred: (1) there was poor communication between the wings in Korea and the maintenance personnel in Japan; (2) there was a lack of controlled scheduling (sometimes as many as 25 aircraft were parked on the ramps in Japan awaiting work); and (3) many of the aircraft leaving Korea were stripped of servicable parts not necessary for the one time flight to Japan leaving holes for the people in Japan to fill. The organization in Japan was not under the control of any one unit it supported so many of these problems went unresolved. This could have been averted by command action and support. Even though there were numerous problems, the in-commission rates for the aircraft in Korea did rise.

At the beginning of the war, the best results were obtained from the second and third classes of organizational structure. Judging from the operational results, the two had the similar success with the rear area maintenance (18:18). The only difference between the two was that the units in the second category were able to more rapidly move to a different K-site when necessary and thus reduced the amount of forward logistic support required.

Those wings which had a high degree of coordination between operations and maintenance were noted to have higher sortie rates, lower accident rates, and lower abort rates than average. This was evident in the 27th Fighter Wing and the 452nd Bomber Wing. When commanders and key personnel were rotated back to the United States, the effectiveness of the wings was observed to rise and fall. There was noted a definite correlation between the results obtained by maintenance and the degree of cooperation between the operational and maintenance units.

The REMCOs were established to take advantage of the pooled resources of the units using the same aircraft and the experiences of the units which had first used rear area maintenance in Korea. The REMCOs, depending on the facilities at the forward bases, split their organizational and field maintenance squadrons. Wings which split their maintenance between Korea and Japan (REMCOs) had 1) 60% of their maintenance plant facilities at forward bases and 40% at the REMCOs; 2) 21% of the aircraft spare parts at forward bases and 79% at the REMCOs; 3) 90% of the aircraft at forward bases and 10% at the REMCOs; and 4) 60% of the mechanics at forward bases and 40% at the REMCOs (29:iii). All aircraft requiring depot maintenance were sent to depots in Japan or in the ZI.

Actual combat generally pushes aircraft to the limits of endurance and capability. Experience in the Korean War

was no different. Excessive flying times plus the use of airfields either not designed for heavy duty use or in poor condition caused considerable failures of aircraft parts. Combat missions in the rough Korean environment forced constant maintenance and modifications to correct for the lack of durability. Vibrations caused by the poor runway surfaces created conditions on heavily loaded aircraft which required additional maintenance to replace instruments, radios, and other flight assemblies. A common problem aircraft maintenance personnel had to deal with was the cracking or failure of landing gear assemblies. To fix the problem, maintenance personnel had to sometimes use assemblies from new, updated versions of the same type of aircraft to replace the failed gears (22:207). Fuel leaks also increased as the aircraft were essentially "beat up" by poor runway and taxiway surfaces.

In 1951, the failures of F-51 landing gear struts was growing in epidemic proportions because of the continued operation in heavily loaded conditions on rough pierced steel planking runways. The pivot shaft of the gear would often break because of the heavy loads and the rough runways. At first, the time between inspections of the struts had been reduced from 600 hours to to 400 hours in an attempt to find cracks before they failed and thereby reduce the number of failures. This did not work and the Fifth Air Force requested new assemblies be made available from the

United States and directed and the shafts be changed every 500 hours. Because the improved shafts took considerable time to manufacture, and adequate supplies of the old shafts were not available, reworked and magnafluxed shafts had to be used and changed every 400 hours until the new shafts became available.

Changes or modifications to aircraft parts or assemblies were often made in the field to adapt to the rugged Korean environment. The Republic Aviation Company advised the Fifth Air Force that the six-ply nose wheel tire of the F-84D was not strong enough to support combat loadings. To remedy the situation, the Fifth Air Force granted authority to the 136th Fighter Bomber Wing to use the nose wheel and tire assembly from the F-84E model on the F-84D model. This change allowed aircraft to handle the steel-planked runways better and increased the life of the tires by 75 per cent (22:207).

Jet aircraft operating from air bases in Korea were subjected to a great deal of damage resulting from the intake of foreign matter into the air ducts. Attempts to police the parking areas, runways, and taxiways seemed to have little appreciable difference in the number of engines failures attributed to foreign object damage in the compressor section. The problem was so bad that 38 J-35 jet engines were reported removed from F-84 aircraft during a thirty day period because of damaged compressors, thrown

buckets, and excessive vibrations caused by foreign objects entering the engine (23:208). In July 1952, the 49th Fighter Bomber Wing developed a protective cover screen for the air intake ducts in an attempt to prolong the life of the engine. The screen was made by covering an easily installed conical framework with number 10 mesh wire. Use of the screen greatly reduced the number of engine failures due to foreign objects from the runways.

At all K-sites in Korea, shelters for maintenance activities were at a premium. The most common type of aircraft maintenance building was an open shed type structure constructed from tropical shell material (1:1). It served as a shelter from rain for maintenance personnel but was unable to keep out the extreme temperatures. A few K-sites had Butler Hangars. This World War II type building was made of prefabricated metal sections with end closures of canvas curtains which usually lasted only a few days after the building was erected. The decision to use prefabricated structures or locally fabricated buildings was made by the operational command based on material and personnel available in the theatre and the tactical situation. If the facilities were lacking, and there was a probable need for the unit to move at a moment's notice, maintenance personnel erected tents. The tents housed engine build-up shops, propeller shops, welding shops, sheet metal shops, dope and fabric shops, armament shops, inspection

shops, and others until either permanent facilities were constructed or new facilities could be found at another K-site (20:151).

Sometimes permanent facilities would not be built by wings arriving at new bases if the unit occupying the base was either near combat areas or if there were plans to move on later. Technical supply personnel would install parts bins and arrange tool sets for aircraft mechanics in the tents. These facilities would often be poor places to work. For example, in one unit a large part of the USAF maintenance personnel came down with debilitating colds because the facilities to keep them out of the bad weather were not available (20:154). Winterized tents and stucco building often were used for barracks. Even after the Korean War ended, permanent facilities in Korea were not constructed because of the diminishing need for tactical forces in the area.

All aircraft maintenance requires proper tools and maintenance facilities, but they were not always available in Korea. Hand tools and ground handling equipment were often critically short. One of the worst examples of shortages was the 6150th Maintenance Squadron which, in November 1950, possessed only a few hammers, screw drivers, and wrenches for its total squadron equipment (18:13). Requirements from the K-sites in Korea would be sent to the FEAMCOM but only a minor portion of the orders would be



immediately filled (19:62). Support equipment was often old, non-existent, or improper for maintenance operations with the newer aircraft. For example, available forklifts had not even been sufficient for peace time operations and could not come near to handling combat support needs (35:15). When the war began, support equipment was at a premium. Tools would be procured from all available sources. For example, contracts had to be awarded to a Japanese manufacturer because the same tools ordered from the ZI would take up to six months to arrive while the Japanese manufacturer delivered the tool 45 days from the date of the award of contract.

Old equipment, World War II, and prior, was used at nearly all K-sites (1:3). The items were often almost beyond repair and were a constant maintenance problem owing to the frequent minor adjustments, quick fixes, and repeated replacement of old, worn-out components. One problem area was that the older, and some of the new, equipment was not built to stand the ruggedness of the environment. Crew chief stands, aircraft tow bars, aft section trucks, engine maintenance shelters, test equipment, maintenance lights, and cockpit and other access ladders were just some of the equipment items which continually required repair or replacement. The reasons for the lack of ruggedness of the old, and some new, equipment were (1) the equipment was made lightweight for air transportation without consideration of

its potential usage; (2) low contract costs were emphasized and the quality of the equipment was below that of the equipment it was replacing or repairing; (3) many items were not designed to take the punishment of the rough field usage found in Korea; and (4) most items were designed for a relatively short life span. Replacement of the equipment was difficult because of the low priority it was given and the difficulty involved in having new support equipment built.

Electrical generators were a good example of the misuse of equipment. Lycoming power generation units, originally designed to be used for high load starting of jet aircraft, were employed in production line maintenance and base work shops as continuous sources of power because of the lack of rectifiers, base power, and capacity of smaller power generators. They were being improperly operated due to tactical operational requirements and the lack of sufficient spares and maintenance support equipment. The continued use of old spark plugs, and the lack of spark plug cleaning equipment, caused the units to be hard to start and provided operating conditions which shortened the life of the equipment.

Supply. Supply by water shipments from Japan connecting to Korean railway averaged five days when transportation was controlled by Fifth Air Force personnel; seven or more days when the supplies were not controlled by

the Fifth Air Force. Delays in receiving supplies were often caused by higher priority ground force personnel (Army), equipment, and ammunition taking precedence over Air Force spare parts and materiel. Supplies were only delivered by air if there was an immediate emergency. "The supply cycle by airlift varied by priority, availability, and location from 4 to 48 hours" (19:54). The uncertainty of supply schedules forced combat units to store more than their immediate needs.

In response to Fifth Air Force requests for an advanced FEAMCOM depot in Korea, FEAMCOM established a forward unit called a Korean Air Materiel Unit (KAMU). The KAMU received, coordinated, and expedited requisitions from Korean air bases. One such KAMU set up by FEAMCOM served the needs of two Korean bases, K-2 and K-3. It operated a truck company which delivered POL, ammunition, and other supplies from rail head, dock, and beach areas to the bases. The KAMU provided two aircraft maintenance teams and assigned them to the bases. The two teams operated under the control of FEAMCOM but substituted as maintenance squadrons for the base maintenance and supply groups. As representatives of FEAMCOM, they provided guidance on maintenance policies and were an important link between the tactical units and the FEAMCOM. In one instance the KAMU, the 4th Fighter Interceptor Wing, and Fifth Air Force representatives discussed the disposition of five F-86

aircraft which had been cannibalized to the point that an excessive number of manhours would have been required to restore them to servicability. The decision reached was that the KAMU would arrange for the aircraft to be returned to the FEAMCOM for storage and rebuilding. This episode lead to a directive on cannibalization which was issued to tactical units that parts would not be cannibalized from aircraft until all other local sources had been exhausted. Tighter local controls over cannibalization were initiated.

Normal requisitions for USAF technical supplies were submitted by Air Base Supply Officers in Korea to a KAMU for forwarding to FEAMCOM. Emergency requisitions were sent by wire or the fastest possible means direct to FEAMCOM from the Supply Officer with an informational copy going to the KAMU. Materials were then shipped by FEAMCOM direct to the requesting unit by air or through the Air Force Liaison Officer at Fukuoka, Japan (19:53). Materiel shipped by water went through Army controlled ports to be forwarded to the requesting unit by rail or truck in Korea.

On most Korean bases POL facilities did not exist and either had to be constructed to provide POL storage for mission requirements or the POL products were stored in the containers in which they were shipped. POL supplies were usually late arriving on-station. Most of the POL products in Korea were transported by rail in tank cars or in 55-gallon barrels (19:62). Frequently, POL products were just

kept in the barrels to allow for easier accountability and transportation. One problem with many of the barrels was that they were often contaminated. The barrels had to be treated inside with a rubber composition to decrease the rust and foreign particles often found. Due to the lack of proper coordination between Army and Air Force supply personnel, or due to combat related causes, POL products often were sitting at a railway station with no place to go. Sometime K-sites were directed to have at least 15 and less than 30 days supply of POL to allow for delays in transportation (19:60). The Army transported POL products in-country by truck or rail whenever space was available. The large number of combat sorties by the Fifth Air Force required an almost continual supply of POL products to meet fuel servicing needs at forward air bases in Korea (19:62). Sometimes, airlift had to be used because it was the only transportation which could supply POL products in time to meet operational needs. POL problems existed throughout the first year because of the large requirements and the lack of large storage facilities. The shortage of POL products slowly disappeared with the construction of 5,000 and 10,000 gallon tanks erected at a number of the K-sites, the installation of fuel pipelines, and the reduced number of combat sorties flown by the combat units.

Logistical support for the Fifth Air Force in Korea was furnished by the 2nd Logistical Command, Pusan, and the 3rd

Logistical Command, Inchon. Both were under the control of the Eighth Army. These depots were responsible for supplying common items of supply to both Army and Air Force. Approval for transfer of supplies from Army to Air Force was require from Eighth Army. Delivery of these supplies sometimes took three to four weeks even though the items were often required for immediate use (20:142). Air Force units in Korea had to draw the common items (such as tents and clothing) from Army depots. Although simple in theory, the Air Force found getting items difficult because of procedural variations and differences in interpretation by the two services (14:26).

In spite of concentrated efforts at all Air Force command levels, a number of units were unable to perform missions adequately because of the lack of aircraft spare parts (22:194). For example, a critical item for the F-86 was the wing-tip tank. The lack of spare wing tip tanks seriously threatened the continuation of daylight interdiction sorties. Some new external tanks had been received from the ZI but were unsatisfactory because of faulty bomb shackles on the aircraft and no stabilizer fins available for the tanks. Two units (4th and 51st Fighter Interceptor Wings) had to operate with one tank on the aircraft which allowed for only two-thirds the flying time regularly available (22:195). External tanks had to be purchased from Japanese manufacturers because they were too

expensive if purchased in and shipped from the United States and because of the long delays shipping from the ZI. Another critical item of concern for F-86 wings was the J-47 engine. They were often in short supply. One of the factors contributing to their short supply was the lack of engine oil seals. Supplies in the ZI were often short and it took a considerable time to send them the theatre. Authority was given to the combat units to service the old seals until new engines and new replacement seals were delivered. This worked but required more maintenance to service the engines.

Various steps were taken during the war in an effort to improve the system for movement of supplies to Fifth Air Force units. For example, AOCF and ANFE (aircraft not fully equipped) procedures were modified to provide more control over spare parts and equipment for F-86 aircraft. One method employed was to establish an anticipated parts forecasting procedure. The 4th Fighter Interceptor Wing was made the focal point in Korea for supply support for all F-86 aircraft spare parts with a representative of the FEAMCOM Director of Materiel on hand to effect centralized control of critical items (22:202).

Transportation. Airlift proved an essential part of the USAF's way of moving personnel and materiel but delays occurred because of the required coordination with other services and the restricted allocation of cargo space. FEAF

Combat Cargo Command controlled all airlift to and from Korea but use of the cargo aircraft had to go through the Joint Air Priorities Board to determine authorizations and priorities. When a maintenance squadron was to move from one K-site to another, all priority equipment was shipped by air and pieces of equipment which were bulky or extremely heavy would be loaded on trucks. Transportation, by air or land, would one day be on-time and another day it would be delayed. It could not be relied upon for maintenance scheduling. Air Force units in Korea were under the constant control of changing Army requirements which usually had first priority for transportation over the Air Force units in Korea. One unit completely moved from the Pusan area to the 38th parallel in nine days (20:195). While, in another situation, transportation delays caused some holiday activities to be postponed. Thanksgiving dinner to personnel at a K-site was delayed a day because of shipping difficulties (20:196).

During the war trucks did most of the short distance hauls from seaports and railway stations to the forward bases. The trucks were constantly in need of repair because of the poor road conditions and rugged terrain. The quality of the gravel surfaced roads was inferior to secondary roads in the United States (24:52). The roads often caused front springs to break and tires to rupture. Every time a truck convoy would return from a trip, some trucks would have



broken springs. The abuse on the tires was so bad that on one trip a convoy used over 360 tires to replace the blown tires (7:411). Some trucks required all the tires to be changed before the journey was over. The effects of weather, especially during the rainy season, the continual use, and lack of repair caused large portions of the roads to be washed out and have numerous deep and often dangerous potholes.

Even without the hazards due to the poor road conditions, driving trucks in Korea was made difficult by the extreme weather conditions. The absence of winterized equipment on the trucks caused extreme discomfort to the convoy drivers. To protect themselves partially from the sub-freezing temperatures, some drivers improvised tops and doors for the trucks through the use of salvaged tents and plywood.

Due to the excessive need for railway transportation, the Eighth Army established a procedure in which all users of the rail transportation had to forecast their requirements in advance. This was accomplished by requiring all users to forecast their rail transportation needs twice a month (1st and 16th day of each month), at least five days prior to usage, to the Eighth Army (21:139). Allocation of cars to the user was based on projected overall needs. The total available loading would add up to 70% of the Korean

rail capacity with the remaining 30% reserved for emergency purposes and for cargo which exceeded estimates.

There was considerable congestion of rail cars at some stations due to frequently changing transportation priorities, enemy action, not enough personnel to load and unload the material, and the lack of proper unloading equipment. One of the biggest areas of congestion was the station at Pusan because it was a major railway intersection and it was one of the two main off-loading ports in Korea. Congestions were caused by shipments of large items such as prefabricated housing and pierced steel planking used for runways. Those items were very heavy and cumbersome, requiring cranes and other lifting devices. Many K-sites lacked the required handling equipment, and the rail cars had to wait in the station until the K-sites could obtain the equipment to off-load them.

Personnel. Local labor provided substantial assistance to the United States military. Over 30,000 Korean civilians supported railway operations (laying new track, repairing battle damaged track, and operating switching centers) under the supervision of the Army. The Fifth Air Force employed a peak of approximately 20,000 Koreans at the beginning of the war for emergency construction jobs creating facilities, buildings, and runways. The number lessened as the number of military troops increased and the need for their services decreased. Korean laborers and assemblers were also

employed to assemble wing tanks and to perform other routine maintenance activities while USAF airmen would supervise (20:151). The use of the Korean civilians released critically needed airmen and engineering personnel from routine and unskilled tasks and enabled Fifth Air Force units to operate below manning authorizations (17:156). This gave the units the opportunity to obtain critically need extra personnel to perform more detailed and technical jobs. There were problems with the Korean hires. These included a language barrier and a shortage of interpreters and poor sanitation habits which posed a possible health risk to the unit's personnel. United States military units wanted the Koreans as long as they had an emergency project to complete or were short of personnel for unskilled tasks. But, when the emergencies were overcome or the units were up to strength, the units showed indifference to the Koreans and they were dismissed (24:76).

At the outbreak of hostilities there was an urgent need for increased manning to provide fillers for understrength commands. During the first few months, manning documents were meaningless (5:5). The USAF filled the FEAF requests for personnel by spreading them to the sub-commands on the basis of stated requirements and priority of missions. In addition, the Thirteenth and Twentieth Air Force were required to move certain units to Japan and Korea. Many personnel were reassigned from the those commands because

they were the only immediate sources of personnel for committed combat and combat support units. Manning was on a "guess work" basis. Personnel were constantly reassigned and placed on temporary duty assignments to meet emergencies. The result was an unplanned manpower distribution, both number and skill level, in subordinate commands in the FEAF.

Another problem experienced in the FEAF was that new equipment, such as electrical ground equipment, would arrive in the theatre in advance of the personnel qualified to operate and maintain the equipment. This was due to the lack of coordination within the FEAF HQ staff since most of the equipment had been programmed for sometime (5:7). The equipment which was delivered without personnel trained to operate it was generally useless to the unit. The training given to personnel in various specialties sometimes provided the necessary "know how" to handle the new equipment. Often the equipment was of a specialized nature and operation and maintenance of the equipment became a problem. This problem was sometimes overcome by the units informing the FEAF of the arrival of the new equipment and having FEAF give new personnel to the theatre the necessary specialized training before their arrival in the unit.

Additionally, the USAF policy for the length of tour of duty in Korea created continuing maintenance problems. The policy was for only a 12-month tour unlike World War II

when overseas assignments were "for the duration". So, when personnel arrived, usually unqualified for maintenance of the assigned aircraft, they faced at least a couple of months of orientation and training to minimally qualify them for maintenance duties. Then, they began to develop skills and accommodations to the Korean War situation as the months went by. Just as they were reaching a fairly high skill level, their tour was up and they were pulled from the unit for return to the ZI. The replacement personnel were usually unqualified and the process had to begin again. At some K-sites, combat-ready rates slightly fluctuated down then up due to the rotation of experienced personnel who were replaced by inexperienced mechanics and crew chiefs. The use of REMCOs, OJT, and technical representatives to aid training somewhat reduced the impact of receiving new and unskilled maintenance personnel.

Some maintenance support was acquired through the contractor technical representatives. Their job, under contract to the USAF, was primarily to provide technical assistance, technical advice, and training support for the equipment their employers manufactured. However, they were often forced into actual maintenance performance because of the conditions previously stated. Further assistance came through contracting for Korean and Japanese support maintenance manpower. The contracted indigenous personnel were able to perform many of the more basic shop jobs

(cleaning the aircraft, removal and reinstallation of parts and assemblies, and lubrication of parts) thus relieving uniformed personnel to perform other more technical or more complicated tasks.

Morale of any unit was important because morale was proportional to the effectiveness and cohesiveness of the units in Korea. A major detriment to morale during the war was the two-sided personnel policy which excluded personnel originally stationed in Japan for 18 to 30 months from a shorter tour-of-duty (12 months) in Korea which was enjoyed by Fifth Air Force personnel stationed in Korea (10:1). A bad morale situation existed causing some animosity between personnel stationed in Japan and personnel stationed in Korea but working at a REMCO because the Fifth Air Force's personnel policy requiring a shorter time required in the theatre until they returned to the United States. Also, morale problems surfaced when Fifth Air Force maintenance personnel who worked at the REMCOs were separated from their wings in Korea and assigned to the REMCOs in Japan. They felt a loss of unit identity and felt that in the REMCO they were not providing important contributions to their unit's mission. Separation from the unit and its harsh conditions in Korea seemed somewhat to be degrading.

With the establishment of assignments by areas (Korea, Japan, or other Far East locations) within the FEAF, a problem arose with the length of tours for Fifth Air Force

personnel. The Fifth Air Force policy was that, regardless of the area of assignment, Fifth Air Force personnel were eligible for rotation based on the Korean tour, 12 months. Although the majority of the Fifth Air Force personnel were assigned for duty in Korea, some were in Japan to solve maintenance problems at established REMCOs. The normal tour for personnel stationed in Japan was 18 to 30 months. The Fifth Air Force's reasons for the 12-month tour rather than a change to the Japan tour length was that (1) the operation was in direct support of tactical operations by personnel assigned to tactical wings, (2) REMCO personnel worked long hours, often seven days a week, (3) personnel often rotated between Japan and Korea, and (4) housing conditions at the Japan bases were comparable to those existing in Korea. The FEAF commander approved the 12-month tour for Fifth Air Force personnel in REMCOs because when the REMCOs began they were thought to be temporary and he did not want to hamper their operations by allowing different tour lengths for Fifth Air Force personnel.

Since permanent facilities were always at a premium in Korea, finding facilities already built was always a boost for morale. Support personnel grew tired of erecting maintenance shelters and barracks every time they moved to a new K-site. For example, one maintenance and supply group experienced notably improved morale when it moved to a K-site which had some troop housing, hangars for shops, a

motor pool, and some warehouses (20:133). Hot showers and good lighting made the move to the new K-site more desirable.

Before buildings or tents could be erected at new K-sites, many personnel had to almost fend for themselves for adequate sleeping arrangements. When the 452nd Motor Vehicle Squadron was first sent to Korea, its personnel had to sleep in sleeping bags because of the lack of adequate housing. During the next week, folding canvas cots were flown in from Japan. They did not get the first tent up and slept in until twelve days after they arrived on site.

#### Supporting In-country

Maintenance and supply support for the combat aircraft in Korea came from several important organizations located outside Korea. The FEAMCOM, located in Japan, provided the supplies and spare parts, supported maintenance activities, and provided technical assistance through depots in Japan and through temporary maintenance and supply units operating in Korea. The Fifth Air Force, located in Japan, provided the personnel for maintenance units in Korea and for REMCOs in Japan. The Japan Air Defense Force (JADF) supported the bases on which the REMCOs were located. The FEAF, also sited in Japan, furnished the direction for all the subordinate commands, FEAMCOM, and Fifth Air Force. The AMC, located in the United States, provided the materiel from the ZI, operated the depots in the ZI, and provided



guidance for maintenance and supply operations to support theatre operations.

Maintenance. The biggest contribution the Fifth Air Force units made to maintenance during the Korean War was the adaptation of rear area maintenance facilities in Japan. The idea of rear area maintenance was first used in World War II (29:11). Used in the European theatre, rear area maintenance took advantage of the equipment and facilities behind the combat zones which had not been destroyed by enemy bombardment. REMCOs lasted throughout the Korean War because they allowed more mobility for the tactical units in Korea and produced higher in-commission rate for the unit's aircraft than did wings totally located in Korea. Located a hundred or more miles to the rear of the operating bases, the REMCOs arose out of a combination of poor operating conditions in Korea and of excellent operating conditions and plant facilities in Japan. Japan was a friendly country not under attack and this permitted greatly reduced stress for the maintenance personnel. In addition, Japan offered an abundance of skilled indigenous labor and a good rail transportation system.

In 1951, the original REMCOs (such as the ones made by the 4th and 27th fighter wings) were established by simply withdrawing men, equipment, and supplies from the wings and establishing a rear echelon maintenance facility at a base in Japan (29:4). Soon after, wings flying the same type of

aircraft found that combining their rear echelon maintenance organization was very advantageous and produced greater output. Thus the name REMCO was coined. After a year of operation, permanent REMCOs were determined necessary because the poor operating conditions still existed in Korea and were not expected to improve. Also, the FEAF did not want to spend millions of dollars to improve the poor conditions in Korea because the maintenance support by the REMCOs had been satisfactory to commanders of the Fifth Air Force and FEAF.

During the last half of 1952 formal actions were taken to establish the REMCO on a permanent basis. Policies, procedures, and organizational structures were developed to accommodate the REMCO system. Some of the actions taken were: (1) consolidate aircraft parts supply giving the REMCOs base accounts and the wings service stocks; (2) place all military personnel assigned to the REMCOs on the same tour-of-duty; (3) raise civilian personnel ceilings to authorize the employment of large numbers of indigenous personnel at the REMCOs; and (4) expand plant facilities and add special engine test stands to increase maintenance plant capabilities. During the process of this evolution of the REMCOs as permanent organizations, two basic patterns of REMCOs operation evolved in Japan.

The first pattern was called the "parent wing". Two or more standard wings participated by contributing selected

maintenance personnel skills and equipment to the REMCO. In return they would receive certain specified maintenance and supply services. One of the participating wing commanders was given the responsibility to supervise the REMCO and his wing simultaneously. This particular wing was designated as the parent wing because the direction for the REMCO came from that wing commander. The REMCO was the sole activity which provided support for the two or more contributing wings. The tactical units and a minimum number of maintenance support personnel were stationed at the forward base. Maintenance personnel and equipment above that required to perform pre-flight and post-flight inspections, emergency engine changes, simple component replacements, and one-time repair of battle damage were retained by the REMCO (16:5). These personnel, plus the personnel of the maintenance squadron of the base-assigned maintenance and supply group, constituted the periodic maintenance section of the REMCO. Aircraft spare parts used at the forward bases were supplied by the REMCOs thereby reducing the quantities of supplies at the forward bases. An example of this organizational structure was an F-86 organization composed of the 51st Fighter-Interceptor Wing (the parent wing), the 8th Fighter-Bomber Wing, the 4th Fighter-Interceptor Wing, and the 18th Fighter-Bomber Wing which jointly operated a REMCO out of Tsuiki, Japan.

The second pattern was called the "reinforced wing". The reinforced wing was an organization used to adapt the organization of a standard wing with the advantages of a REMCO. The reinforced wing consisted of a combination of two or more combat groups and one REMCO under the command of a wing commander. This combination required extensive reorganization but was implemented because it provided easy channels of communication and authority up and down the chain of command, made the wing self-sufficient, and erased the overlap and duplication of command. The REMCO was supplied through base supply channels and was responsible for resupplying the forward base units. An example of this organizational structure was found in a F-84 organization made up of the 58th Fighter-Bomber Wing, which was composed of the 58th Fighter-Bomber Group, the 474th Fighter-Bomber Group, and the 58th Maintenance & Supply Group. The REMCO was located in Itazuke, Japan.

While the REMCO concept was well accepted at the major command levels, it was not generally accepted by the command and supervisory personnel at the squadron level [29:22].

Loss of some squadron equipment and personnel and, particularly, loss of control of the whole job of maintenance were the two biggest complaints about the REMCOs. The commanding officers felt the responsibility for maintaining the aircraft should not be divided between two bases.

Not all wings in Korea used rear echelon maintenance techniques. A comparison was conducted by the FEAF between two light bomber units (3rd and 452nd Light Bomber Wings) using different methods of aircraft maintenance. The 3rd Light Bomber Wing moved entirely to K-8 in 1951. Small shops buildings and two aircraft maintenance sheds were built by the wing. The 452nd Light Bomber Wing moved to Korea but accomplished the majority of its maintenance at Miho, Japan. During a six month period, the comparison showed higher in-commission rates were possible through the use of rear area maintenance.

The wing entirely based in Korea decreased from a starting in-commission rate of 78 percent to a rate of 65 percent. The monthly flying hours dropped from 5,425 in July to 3,904 in six months. Staff visits indicated the aircraft were in poor condition. The other wing, using a REMCO, experienced in-commission rate rising from 57 percent to 82 percent (16:3). The flying hours increased from 3,884 in July to 4,612 in December. Staff inspections revealed the rear area maintenance kept the aircraft in better condition.

At forward locations in Korea both operational and maintenance personnel worked together to insure aircraft were properly scheduled for maintenance. The operational unit used its aircraft to stagger the inspections of particular aircraft over the entire month. Each squadron

was in charge of scheduling its aircraft for missions, while operational personnel at the group level monitored aircraft which were within 20 hours of a major inspection to allow for an even flow of work to the REMCO. Aircraft within 20 hours of inspection due were reported to the REMCO. Daily contact between the forward bases and the REMCO took care of regular scheduled flights to and from the forward areas as well as schedule adjustments due to weather or mission requirements.

The basic functions of the maintenance personnel in the REMCOs were similar. General methods used for inspection and shop repairs were alike in the wing-base and REMCO organizations. In both, USAF technical orders were followed in maintenance work. The use of specialized dock, production line, or crew techniques were dependent on the facilities available, the qualifications of the personnel, and the amount of work required (16:6).

Upon arrival at a REMCO from a forward base, the aircraft was given a "shake-down" inspection to determine if any extra maintenance needed to be done other than the scheduled routine inspection. A work sheet was made for the aircraft and the work was coordinated with production control while the aircraft was being cleaned on a wash rack. Production control released a work order for the aircraft and issued instruction slips for the necessary shop work. Minor field maintenance and battle damage repair was

accomplished during the inspection with both inspection and repair being done at the same time as, but not interfering with, each other. Aircraft requiring major repair for battle damage, or requiring excessive shop work, were sent to the field maintenance part of the REMCO. As soon as the work order was released, the materiel control unit started to position the aircraft's components where they would be accessible to the inspection dock work positions or to the production line site where they could be used. Materiel control also obtained and sited parts requested by the inspectors (16:9).

The maintenance activities of the different REMCOs varied slightly due to different facilities available and the number of wings, or groups, supported. However, the basic organization of the REMCOs was the same. The REMCO was operated by a maintenance and supply group which consisted of a supply squadron, a maintenance squadron, and an air base squadron. The group headquarters was responsible for the (1) administration, (2) personnel, (3) maintenance, (4) supply, and (5) transportation needs of the REMCO. The supply squadron took care of unit supply, consolidated base supply (materiel used by the supported groups), materiel services, salvage and disposal, and POL requirements of the REMCO. The maintenance squadron provided the repair and maintenance services of the REMCO. The air base squadron provided items and services common to all bases, such as

office equipment and supplies, electrical service, and morale and welfare services for the unit's personnel.

Under the REMCOs the aircraft spare parts and supply system were reorganized. Base supply levels of stocks were transferred to the REMCOs and augmented service stocks were established at the REMCO-supported bases. REMCOs concentrated critically short items in one place allowing for better control and accessibility. The REMCO operation provided more nearly optimum conditions for the cannibalization of critical items. One disadvantage of the centralization of stocks at the REMCOs was that it sometimes created short duration AOCP situations at the forward bases. An item out of stock at the forward base was usually in stock at the REMCO but delivery of a part from the REMCO could take from one to three days depending on the mode of transportation.

The FEAMCOM, besides providing maintenance and supply support for the theatre, developed modifications for aircraft parts. For example, the prototype protective jet engine inlet screen (mentioned earlier) was forwarded to the FEAMCOM for testing and evaluation. Authorization was requested from the FEAF, and later given, to either locally manufacture or obtain by commercial procurement 249 screens; one screen for each F-84 aircraft. FEAMCOM itself undertook the manufacturing of the screens. A couple of months later, 78 of the screens were sent to tactical units in Korea. The



Fifth Air Force provided its input by developing standard operating procedures for the installation, handling, and removal of the screens.

The FEAMCOM also designed and manufactured a new engine cradle for transporting R-4360 aircraft engines.. Formerly only C-97 and C-119 aircraft could be used to transport the engines to and from the ZI. With the new cradle, C-54 aircraft were also able to transport the engines. This allowed for a quicker return time from the ZI because more aircraft could be scheduled to carry the engines.

Depot level maintenance and modifications which were beyond the capabilities of the field organizations were the responsibility of the FEAMCOM. This applied to battle-damaged aircraft, major modifications to equipment, and the periodic overhaul of aircraft (35:89). When problems arose which were beyond the normal scope of the FEAMCOM, the AMC provided technical assistance to help solve the problems. Two such instances were the assistance provided for solving major problems on the C-119 and the F-86 aircraft.

Prior to November 1950 the C-119 aircraft had experienced several major accidents which investigations attributed to failures of propeller control units. Investigations revealed the propeller oil reservoirs were being improperly serviced with a grade of oil with too low of a viscosity resulting in loss of oil and failure of the propeller control. When this happened, the propellers would

move to full high revolutions per minute (RPM) but the propeller blade settings at the full high RPM would not enable the aircraft to maintain altitude. A quick fix was to increase the angle of attack of the blades. While this action was being taken the AMC further investigated to determine a final fix. The AMC brought a team from the Hamilton Standard Propeller Company to Korea to install new main oil pumps in the C-119 propeller controls. The company also instructed FEAMCOM personnel on the correct control pump installation procedures. A few months later some propeller difficulties were still being encountered in Korean operations. AMC instructed FEAF units to further increase the pitch of the blades at high RPM in the event of a propeller control mechanism failure. This solved the final aspect of the problem.

Another C-119 problem was with the engine nacelles. Structural failures were being experienced due to corrosion and the lack of durability operating in the Korean environment. For a short time, all C-119 aircraft were grounded pending a suitable solution for the problem. To repair the problem, the AMC sent nacelle structure reinforcement kits to the FEAF. Upon receipt of the kits, the FEAF completed modifications to all C-119 engine nacelles in a five month period and another nagging problem was overcome.

Shortly after the first F-86 was used in combat, reports circulated about in-flight difficulties releasing the external fuel tanks (35:94). Instead of the nipple connection releasing properly, the fuel line hose would tear off. The AMC was advised of the problem and was asked to recommend corrections. The aircraft only released the wing tip tanks when engaging enemy aircraft, so some action was urgently needed to assure for the release of the tanks at high speeds and high altitudes. The AMC, in cooperation with the North American Aviation, determined that moisture collected on shackles which held the tank to the wing. In flight, when the aircraft climbed to high altitudes the moisture froze around the shackles. The ice would not allow the shackles to release, so the tank could drop off. To solve the problem, the AMC recommended the shackles be removed, be thoroughly cleaned, and be packed with a special non-freezing compound developed by Dow-Corning. Also, the AMC recommended the hose connections to the tanks be lubricated to prevent the hoses sticking to the tanks after release. The FEAF, and FEAMCOM, acted on these recommendations and the problem was resolved to everyone's relief.

To achieve as much self-sufficiency as possible, the FEAMCOM made extensive use of indigenous skills and local materials. Japanese contractual services supplemented depot maintenance programs from the beginning of the war.

Initially, the Japanese industrial capacity was quite low and at first maintenance contracts were only for labor with tools, equipment, spare parts, and technical knowledge being furnished by the FEAMCOM. This situation changed as the industrial capacity gradually improved. The first full maintenance contracts were for depot inspection and repair of C-46 aircraft and they proved highly successful. Later in the war contracts were negotiated with three Japanese aircraft companies for the depot inspection and repair of F-51, T-6, C-46, and B-26 aircraft (17:116). These, too, were satisfactorily accomplished.

Supply. Supply of the FEAF units in the theatre was one of the major responsibilities of the FEAMCOM. Its depots acted as funnels for all supplies and aircraft entering the theatre. Tens of thousands of items and thousands of tons of supplies ranging from bombs to small electronic units were stocked by the FEAMCOM. The supplies coming from the ZI were supplemented by a wide-spread theatre procurement program ranging pretty well across the whole Pacific area but principally concentrated in Japan. Local purchases saved on initial costs and delivery time and quickly increased theatre self-sufficiency.

Prior to the war, spare parts support from the ZI was satisfactory for the existing peacetime conditions. When combat began in Korea and maximum sorty rates had to be maintained the existing stocks were rapidly depleted. As

soon as replacement parts arrived at the FEAMCOM they were immediately forwarded to operational units in Korea. Rapid changes in the number and types of aircraft, lack of experience with jet aircraft, lack of accurate consumption data further reduced available supply support. In the early days of the war, the ZI depots challenged requisitions on the grounds that past consumption rates did not justify the requests (17:113). This caused some rather heated exchanges as the people in the FEAMCOM, and in Korea, talked by telephone to depot personnel in the ZI. Soon, the ZI depots began to understand the war was creating new consumption data. Experience factors gained from combat operations were constantly being revised. Requisitions had to reflect these changes in experience factors and the ZI depots accepted the idea peacetime consumption rates could not be used as an inflexible rule for combat support.

Early in the Korean War, Japan provided only a minor portion of materials for the FEAF. Japanese industry did not yet possess the technical expertise, facilities, or equipment to manufacture needed products. However, Japan was rapidly improving and by the second year of the war the FEAF was purchasing a much greater mix of materials from Japan at large savings in end item costs and lead times. Some of the items purchased were fuel drop tanks, bomb fins, napalm tanks, and machine tools. Savings on the drop tanks

and machine tools were over 50 percent compared to prices of similar items from the United States.

The increased number of aircraft controlled by the FEAF, and the increased operational activities, demanded huge quantities of support materials. Under combat and climate conditions deficiencies in many supplies soon became apparent. Demands for materials and solutions to many operational problems often fell upon the shoulders of the AMC. The most important activity undertaken by the AMC in support of the FEAF was the procurement, assembly, and delivery of supplies, spares, and tools. Excellent examples of the efficient AMC support came in response to aircraft engine problems.

The need for more bombers, such as the B-29, and the increased flying by combat units in the Far East, forced the AMC to expand its engine modification and overhaul program in the ZI. As a result, engine parts soon became scarce. This was due to the lack of spares in the ZI and because the production of engine parts took over five months lead-time. One problem in obtaining spares started in October 1950 when a manufacturer of certain parts for the B-29 engines went on strike. With the production stopped, the AMC figured the current stock of spares for the engines would be used up in a month. The AMC negotiated with the company and union officials and was permitted to obtain release of items completed but not yet shipped out of the strike-bound

factory. These actions helped fill the requests for engine parts by the FEAF organizations until the strike ended a month later.

In order to find an alternative to engine repairs being accomplished by companies in the ZI, to save funds and shipping time, the AMC and FEAF established engine repair facilities in the theatre. One such facility was the R-3350 engine build-up line in Japan. The AMC had the necessary tools and equipment sent to the FEAF to assist in the engine build-up. Prior to the build-up line, the AMC had been sending over large numbers of engines and quick engine change assemblies to facilitate repair operations in the theatre. This facility, and others established later, provided a valuable asset in the theatre, increasing the self-sufficiency of the FEAF.

To increase the time between overhauls of jet engines at the depot level, the AMC studied the feasibility of permitting engine repairs and major parts replacements to be accomplished by field maintenance units. The results were positive and the AMC sent over supply parts, tools, and equipment to three FEAF bases in Japan. FEAF assigned supply and maintenance division personnel on temporary duty to the ZI so the AMC could instruct FEAF personnel in correct supply and maintenance procedures. AMC also produced technical handbooks for the instructions for minor

repair procedures at the field level for the J-33 jet engines for F-80 aircraft, among others.

The greatly increased use of F-51 aircraft in the theatre early in the war caused serious shortages of special tools and ground handling equipment for the aircraft by the end of July 1930. To remedy the situation, the AMC withdrew materiel from Air Force stock and from Air National Guard stock to fill the shortages. By mid-August, 93 percent of the F-51 special tools and ground equipment had been shipped to the theatre. The remaining items were later delivered by action taken by the San Antonio AMA. Creativity and initiative allowed the technicians in the field to find ways to get their jobs done even without the required equipment. Their jobs were greatly simplified, and made safer, when it was issued to them.

Transportation. Rail transportation in Japan was controlled by the JLCOM through the 8010th Transportation Military Railway Service. Requests for routine or ordinary rail service were made to the local rail transportation officer (Army) who was the representative of the 8010th. Unusual or special requests were made through channels to the JLCOM by the requesting unit.

Korea was not the only place in the Far East with problems with its in-country transportation. Service roads near the port of Yokohama were often poor and narrow, railroads were almost exclusively for moving materiel to



outlying bases. Water transportation was used when the equipment was too heavy or large for rail movement (19:70). The capacity of the rail cars available in Japan often made shipping large or heavy equipment very difficult. The small railroad tunnels in Japan sometimes necessitated the dismantling of equipment (such as the K-53 truck which had to have its tires removed) which would have normally gone through tunnels in the United States. The lack of off-loading equipment at small bases was another obstacle which resulted in the use of water transportation to ports or beaches nearest the military sites. But, then too, ground transportation became a problem but for shorter distances.

The JLCOM also controlled water transportation space allocation to and from Japan, as well as between Japanese ports. Requests for water transportation were made through the FEAF which would then send the request to the JLCOM. Although the requirements for water transportation in the theatre were generally met, many times the available space was not adequate or was not efficiently used. A space allocation committee existed under the MSTs but did not have the authority to allocate space for the theatre command. Working agreements between the three services had to be made so shipping space could be procured at the working level. The Chief of Transportation (Fifth Air Force in Japan) was responsible for obtaining all transportation for movement of materiel and personnel for Fifth Air Force units

within Japan and from Japan to Korea. he was the principle contact with the Army and the MSTs.

Air transportation was crucial to the FEAF because it airlifted critical cargos and high-priority personnel to the Far East theatre in the tonnage or numbers required. Before July 1950, fewer than 60 MATS aircraft were airlifting 70 tons of materiel a month to Japan. Within a month, 95 tons of airlift a day were being delivered to Japan alone from the United States. By September, 250 military aircraft, commercial carriers, and UN aircraft were airlifting a daily average of 106 tons to the entire Pacific area (30:16). By the end of August 1950, 66 commercial aircraft from 17 airlines (United, Pan American, and others) were operating in the Korean War airlift. The commercial fleet was reduced to 33 by November because of reduced requirements for airlift. Afterward, the number of commercial carriers fluctuated due to the constant changes in the needs of the FEAF. Even though there was strong support from the commercial airlines, the majority of military cargo airlift was provided by the MATS.

To handle the tremendous flow of cargo and personnel to the Far East, MATS used three different air routes from California to Japan. The shortest route was from Travis, AFB to Tacoma, Washington, then to Anchorage, Alaska, then across the Aleutian Islands to Tokyo. The total distance was 5,688 miles and the flight took 33 hours. The second

route, which was flown by commercial airliners, was from Travis, AFB across the Pacific Ocean to Honolulu, then on to Tokyo via Wake Island. The flight took 38 hours. The third route, which was used by military cargo aircraft, was from Travis AFB to Honolulu, then on to Tokyo with stops at Johnston Island, Kwajalein, and Guam. This route was 8,083 miles and took 45 hours.

At the outset, USAF airlift forces in the Far East consisted of only some twenty-five C-54 aircraft. In the first week following the North Korean invasion, the C-54 aircraft performed night and day shuttles between Japan and Korea hauling materiel and evacuating personnel. After the Communists overran all of the South Korea airfields capable of receiving the C-54s on a continual basis, several dozen C-47 aircraft were gathered from base support and air logistics roles in the Far East to join the C-54 aircraft (4:62). Anticipating increased troop operations and resupply roles, the FEAF gathered some C-46 aircraft and sixty-four C-119 aircraft for airlift in the theatre. In September 1950 the Combat Cargo Command (CCC) was formed and given these aircraft plus all Fifth Air Force cargo aircraft. The CCC was organized as a parallel command with the Fifth Air Force under the control of the FEAF. The CCC Transport Control Center at Ashiya, Japan, scheduled all missions, monitored the progress of flights, and diverted aircraft when necessary. The CCC's mission was to provide

all airlift within Japan and between Japan and Korea. In September 1950, the CCC was made up of the 1st Troop Carrier Group, the 314th Troop Carrier Group, and the 374th Troop Carrier Wing.

Prior to July 1950, requests for air transportation from Japan to adjacent islands were made to the FEAMCOM. Requests for air transportation between Japan and the United States and Korea were made to the FEAF. During September 1950, the FEAF Joint Air Priority Board, which represented the Army, Navy, and Air Force, was established to allocate the CCC capabilities in the theatre and MATS capabilities between Japan and the United States. Each week the CCC furnished the board a statement of its airlift capabilities. After deliberating on the tactical situation, the board allocated aircraft tonnages to the using services. At the CCC HQ in Ashiya were liaison officers of the Eighth Army and the FEAF, who comprised the Joint Airlift Control (26:150). These officers received specific requests for air transport from their services and decided what was to be moved and in what priority, keeping the requirements within the allowed tonnages. Navy requests for airlift were handled through the Army Liaison officer. This system continued throughout the war.

Once the supplies and equipment requisitioned by the FEAF had been obtained from sources in the United States by the AMC, it became AMC's responsibility to see that the

supplies reached the right destination. To accomplish this, the FEAF had to first furnish the means of transportation of the supplies from the United States to the destination either through the MSTS (sealift) or MATS (airlift). Second, the FEAMCOM would indicate the precedence of priority of its requisitions. The AMC's job was then to assign the priorities and method of shipment to the theatre (3:49). The AMC maintained the procedures to control, expedite, and follow up on all shipments to insure the materials were getting sent to the theatre as soon as possible.

At the beginning of hostilities, the AMC negotiated contracts with several commercial airlines (including Pan American, Northwestern, and United) to support its operations. These aircraft were the commercial aircraft which supported the military cargo aircraft of the MATS. Operational and administrative control of the airlift was controlled by the MATS, with the AMC providing logistical support. This support consisted mainly of providing POL products, drop fuel tanks for the commercial airlines, and certain electronic equipment to the airlines. The great demand of airlift requests necessitated the diversion of a great deal of Air Force air cargo to Marine transportation. Quotas for airlift from the ZI were controlled by the priority board, which was previously mentioned.

All sealift to the Far East was handled through the Army San Francisco Port of Embarkation (3:51). Although Air Force-peculiar items were segregated, common items for the Army and Air Force were not. The Air Force had been trying to attain an agreement with the Army to segregate the two services' common items but the agreement was not completed before the war and was not completed during the war either. The Army's Port Materiel Officer had on-the-spot control of items sent to the Far East. The Port of Aerial Embarkation during the beginning of the war was Travis AFB. There the Air Force maintained control of airlift deliveries to the Far East.

Aircraft destined for the Far East (B-29, C-47, C-54, C-46, and C-119) were flight delivered (because of their large size) whenever possible with combat crews and maintenance spares aboard. Fighter and other short range aircraft destined for the Far East were usually loaded on aircraft carriers in combat ready condition. Combat crews, maintenance personnel, the maintenance parts, and aircraft spares accompanied the aircraft on the carriers to Japan.

The Air Force share of the total airlift tonnage available from the ZI to the Far East theatre was determined by the Joint Air Priorities Board of the theatre and the Joint Military Transportation Committee in Washington (3:52). Within the quota given the Air Force, the FEAMCOM indicated in requisitions those items it wanted delivered by

airlift. The Sacramento AMA was then responsible for securing priorities with the liaison officer at Travis AFB. Airlift for Air Force items was classified in the following priorities:

Priority one - Flash top urgent for emergency requirements.

Priority two - Parts for aircraft AOCP or aircraft not combat ready.

Priority three - Critical aircraft engines.

Priority four - Special projects and critical spare parts.

In all the above, except the first, the Sacramento AMA could downgrade or change the designation to Marinex if necessary to avoid backlogs for airlift. Priority for sealift was handled in a similar manner between the FEAMCOM and the Sacramento AMA for both Marinex and routine sealift through the Sacramento AMA Liaison Offices at the San Francisco Port of Embarkation.

## V. Lessons Learned

The Korean War was the the United States' most recent 'come-as-you-are' (25:34) conventional war. The United States military was unprepared for a war in Korea and was caught by suprise when the North Koreans invaded South Korea. The airlifting of materiel and personnel from Korea to Japan and the first combat missions were accomplished by aircraft and Air Force units already stationed in the Far East theatre. The demobilization of World War II all the military servives, and the absence of preparation for war, just prior left the USAF with few options to support the units in the theatre. Some of the major lessons learned during to the war were: (1) innovations were essential to provide logistical support to combat units; (2) the host nation can provide critically needed support; and (3) there was a clear-cut need to automatically resupply committed forces with certain recognized essential supplies (25:34).

Innovations, such as REMCOs and the use of contract labor, provided important maintenance contributions to the war effort. REMCOs made use of the safe and already available facilities in Japan. They also brought together maintenance and supply personnel and equipment from units using the same type aircraft to provide efficient and prompt repair at rear locations for aircraft of combat units in Korea. The contract labor provided large numbers of Japanese and Korean personnel to perform jobs the USAF would



have been unable to perform with the limited personnel it had available. The contractors technicians from United States manufacturers were of superior assistance in both Korea and Japan.

The facilities, personnel, and manufacturing capabilities of Japan made up for the scarcity of needed resources in Korea. The bases in Japan provided a close source of supplies which could not have been provided on a timely basis if the combat units in Korea had to deal only with organizations in the ZI. The close proximity of the command headquarters of the FEAF and the FEAMCOM allowed units to get the support they needed in a rapid fashion.

In Japan and Korea, indigenous labor provided essential services for port, transportation, depot, and building operations. Without this support from the host nations the number of combat operations would have been greatly reduced. When supplies were not available from the ZI, Japanese industries were contracted to make the substitutes. Korean labor helped build many of the buildings and facilities ultimately used by the combat units. They were also pivotal to the building of much of the railway lines, roads, and runways in Korea.

Due to demobilization and the thought the Korean War would not last longurgency often seemed not to be recognized and replacement spare parts took a long time to reach the FEAF units. The USAF also made resupplying the theatre

difficult by using old World War II combat usage rates and usage rates only for conventional aircraft, not jet. Combat usage data had to be continually updated so the units in the Far East were shipped enough supplies for a given period. An automatic supply system might have insured that combat units received supplies and spares, which have a fixed operational life span, on time. The automatic supply, to be effective, would have to consider not only the number of units which need support but also the flight operations required and the environment in which the units would have to operate. Because of the long delays between the filling of supply requests, resupply efforts had to be supplemented by the use of contracts with Japanese industry, by cannibalization, and by the use of equipment not designed for a particular job.

Maintenance. Some of the lessons learned were:

- (1) Contract maintenance provides an excellent source of labor to support maintenance activities in the theatre: if the combat situations permits the use.
- (2) Jet engine minor repair should be accomplished in the theatre to support combat operations.
- (3) REMCOs allowed for more mobility for forward units and provided an effective method of maintaining aircraft.
- (4) Contractor technical representatives provided invaluable maintenance assistance to units in the theatre.
- (5) The combat environment contributes heavily to the quality and extent of the aircraft maintenance performed.

Due to the large number of aircraft, and the combat missions flown over Korea, depot maintenance repair had to be diverted to commercial facilities because the maintenance organizations in the theatre would have been unable to keep up with the large number of aircraft requiring depot repairs. The commercial facilities in Japan were an excellent and economical method of taking care of the increasing needs for aircraft maintenance. Japanese firms which conducted depot inspections and repair proved efficient and highly successful. Contract maintenance reduced the USAF man-hour backlog and greatly increased the availability of theatre military depots for battle damage repair and other high priority projects.

Jet engine minor repair consisted of the removal, repair, and replacement of engine components in sections of the engine where the fuel enters and where the ignited fuel burns. Inspection and minor repair of these parts in the theatre, instead of shipping the engines to the ZI, increased the life of the engine and greatly reduced maintenance turn-around time. This form of local repair also reduced the number of engines in the transportation pipeline, reduced the number of engines needed in the theatre, permitted earlier diagnosis of troubles, allowed for preventive maintenance measures, and reduced the number of man-hours for engine removal and the installation of new engines.

The REMCOs in Japan had many outstanding advantages and allowed for a higher aircraft in-commission rate for combat units using this system of maintenance. The major advantages of the REMCOs were: (1) they allowed for increased mobility and decreased the number of personnel and amount of equipment needed in the forward areas; (2) they were able to take advantage of ample facilities, better working conditions, and a stable environment in the rear areas which were not available in forward areas or in under-developed combat areas; (3) they kept support problems (transportation and warehousing) in forward areas to a minimum; and (4) they had better logistics support (such as the consistent flow of supplies) than would have been available in the forward areas.

At the beginning of the war, the FEAF had to quickly build-up its organizations. Due to the fast rotation of personnel in the theatre because of the twelve month tour in Korea, and the introduction of new equipment, a large percentage of replacement personnel were not qualified to maintain the aircraft and support equipment. The only two solutions were on-the-job training (OJT) and increased use of technical representatives. OJT was administered to all new personnel in the theatre at some expense to combat capabilities. The technical representatives provided a permanent knowledge base and assisted in repairing and replacing equipment, made recommendations on how to correct

certain malfunctions, and provided procedures for preventive maintenance which was often beyond the scope of the new personnel in the theatre. They provided invaluable services which could have only been found in experienced military maintenance personnel. But, due to twelve month rotations of the military personnel, the contractor technicians were often the only source of real technical help.

The rough Korean environment, combat actions, and the available facilities in Korea had considerable effect on aircraft maintenance. The extreme temperatures and the lack of protective maintenance facilities caused maintenance personnel not to always provide the specific care the aircraft required. For example, some forms of maintenance just could not be accomplished in the extreme cold and while wearing protective clothing. Poor runways, and debris from the runways, caused additional maintenance work as they vibrated the loaded aircraft while taxiing or rolling on take-off, or as the debris cut tires, severely damaged internal engine parts, or otherwise created faults. The lack of proper maintenance facilities reduced the capabilities of the maintenance units in Korea and eventually lead to the further deterioration of the aircraft.

Supply. Some of the lessons learned were:

- (1) One logistics USAF agency serving the needs of the entire theatre is more effective and flexible than separate logistics agencies assigned to each of the theatre Air Forces.

- (2) Support spares and test equipment for new equipment should be made available concurrent with the introduction of the new equipment into the theatre.
- (3) Accurate equipment, and component, consumption data in the theatre must be made available as soon as possible to allow proper forecasting of replacement requirements.
- (4) Common items used by two or more services should be segregated and assigned to the separate service prior to delivery to the theatre.

The biggest reason for the FEAMCOM was the need for accurate accounting and control of all theatre supplies. If the three Air Forces (Fifth, Thirteenth, and Twentieth) each had its own logistics organization during the war, the theatre commander would have had a difficult time centralizing control of all the facilities and materiel in the theatre. The centralized control of the supplies in the theatre gave the theatre commander more flexibility to redistribute supplies and equipment where the needs were the greatest.

New aircraft were often delivered to the theatre without the proper replacement spares and the technical orders to be used to maintain and repair the aircraft. The lack of sufficient support spares increased the workload by forcing the maintenance personnel to improvise and make-do until the spares and technical orders arrived. Often, equipment was improperly used which resulted in the equipment falling into disrepair sooner than expected or failing to work at all.

Units were supplied through the use of consumption data. Updated consumption information was constantly needed to permit needed replacements to be quickly shipped. Inadequate forecasting for spares by use of the old peacetime consumption data, or by World War II combat data, contributed to shortages and delays in Korea for items critical to the proper repair of equipment. An example of such was engine oil seals for almost all aircraft. Correct forecasting of requirements for replacement parts and supplies would have soon reduced the number of aircraft grounded due to lack of spare parts.

The common items used by both the Air Force and the Army were under control of the Army. This left the Air Force dependent on the Army for such things as POL products, vehicles, and housing materials. This dependence reduced the effectiveness of the Air Force units in Korea and the generally unsatisfactory condition existed throughout the war.

Transportation. Some of the lessons learned were:

- (1) Where the USAF is providing airlift for all services within a theatre, a joint service priorities board under the theatre commander should be established to allocate theatre airlift capabilities relative to the need of the service.
- (2) To expedite delivery of supplies received from the ZI, an intransit depot should be established at a major port vicinity, or at major ports, in the theatre.

- (3) An intra-theatre agency should be established to coordinate and allocate land, sea, and air transportation available in a unified overseas area.
- (4) Aircraft should not be shipped by vessels not designed for and already suited to the transportation of aircraft.

The joint service priority board was essential and was the most equitable way to allocate airlift space. This was the best way to weigh the competing demands of the services and insure effective use of airlift. The board allocated tonnages to each of the services. The mission of the aircraft and the contents to be transported were determined by the services separately. This allowed each service to maintain some control over meeting its requirements for airlift speed and priority.

All USAF materiel shipped from the ZI went through the port of Yokohama, Japan. The materiel was off-loaded and transported to the FEAMCOM depot. If it was to be shipped to another destination in the theatre (other than another base in Japan), the materiel was then transported back to the port and loaded on another intra-theatre ship. This caused delays and excessive costs. With the establishment of an in-transit depot, materiel received at the Yokohama port could be immediately routed the requesting organization in Japan. Materiel destined for organizations in Korea could be moved on the next available intra-theatre ship without long delay caused by moving and re-moving in Japan. The in-transit depot still permitted the theatre commander



to control all theatre assets as required. While other organizations materials would be delivered directly to their location from the depot. This system would still allow for the control of all the theatre by the theatre commander.

A large and continuing transportation problem for the USAF units in Korea was their lack of control over land transportation; railway and truck. The requests of the Air Force were always at the whim of the Army which controlled all surface transportation in Korea and Japan and usually made sure its needs were met first. A joint service board successfully controlled airlift in the theatre. The same board should have also allocated land and sea transportation for the separate services in accordance with their needs. This would probably have reduced the waiting time for transportation and reduced the general dissatisfaction with the system. This was important in Korea because there was almost constant movement of wings from one K-site to another during the first year of the war.

At the time of the Korean War, USAF fighter aircraft could not fly from the United States to the Far East. They were shipped aboard aircraft carriers, or other ships, from United States ports to either Japan or Korea. Shipment on open decks of freighters, or tankers, was harmful to the aircraft. Even when wrapped in cocoons, salt spray began long-term and often severe corrosion of unpainted surfaces of the aircraft. Aircraft shipped on the hangar decks of an

aircraft carrier were much more protected and this was the preferred method of shipment. It would also be the least expensive.

Personnel. Some of the lessons learned were:

- (1) Plans to provide support personnel to combat theatres should be made prior to the onset of combat.
- (2) Training programs in the ZI must be geared to the immediate needs of field organizations in combat areas.
- (3) Training programs must provide qualified people to maintenance organizations in a combat area. Such units should never be handicapped with unqualified people in large numbers and a continuing, overburdened, training problem.

One of the biggest problems during the war was the lack of trained personnel, especially in aircraft maintenance. Throughout the war, new maintenance personnel arriving from the ZI were immediately placed in units with the highest priority missions. Whether they had the proper skills for the new job seemed not as important as filling vacancies. The personnel system thus worsened the problem rather than helped solve it.

During the war, the USAF introduced new, and more capable, aircraft to the theatre. This was beneficial for operations but a major problem for maintenance because the USAF did not concurrently assign qualified maintenance personnel and provide essential technical publications and required spare parts. Therefore, very often unqualified people were forced to attempt to maintain new, more complex,

aircraft, and support equipment, often at the expense of success. Far too often, the people performed in good faith but in fault and aircraft were grounded for un-necessarily long periods awaiting qualified support. Further, the unqualified personnel created an unacceptable workload on the unit as it attempted to train them while simultaneously trying to meet mission requirements. This should not have been the situation in a combat area. Unqualified personnel must not be assigned to units in combat zones - even if is at the expense of units in the United States or other foreign theatres.

## VI. Conclusions and Recommendations

One of the best preparations for the future is to look into the past. The Korean War provides many important insights which can still be used in today's USAF. The United States can no longer expect the luxury of several months, or years, to build up its forces to fight a conventional or nuclear war. Waiting until after the conflict has begun will be too late. The motto of the USAF logistics agencies, as that of the Boy Scouts, should be "Be prepared."

The demobilization of the military after World War II left the United States unprepared to support the Air Forces in both the European and the Pacific theatres simultaneously. The supplies on hand in the Far East were only capable of supporting peacetime defensive activities. When the Korean War started there was a great scramble for aircraft, equipment, and spare parts. Surplus from World War II, stored in the theatre, had to be used to bridge the gap until materiel could be sent from the United States. Throughout the entire war there were many incidents of aircraft being grounded because of the lack of parts. The demobilization of the military forces had given opportunity to the majority of combat-experienced, skilled mechanics and technicians to leave the Air Force. This left mostly new personnel who lacked the expertise and the experience required to support combat activities. When these minimally

qualified, or unqualified, personnel were sent directly from the United States to Korea or Japan much valuable time was required to train them in the unit (OJT). This was a needlessly restrictive imposition on units subjected to combat stress and mission requirements. It should not ever again happen.

Continual reductions in the military budgets and the constantly increasing costs of new military hardware resulted in reductions of spare parts purchases for the new hardware and reduced funds for training personnel to operate and maintain the new equipment. When the equipment was needed in a combat situation, without sufficient spare parts and without qualified personnel to repair or replace the spare parts, the utility and life span of the equipment were greatly reduced. The pressures and expenses of continuing combat cannot always be met but, certainly, the conditions experienced in Korea should not be repeated.

Lack of spare parts and equipment, plus the use of World War II equipment, often hindered maintenance activities. Aircraft were grounded because they had to wait for replacement parts to be manufactured and sent to the combat units in Korea. Many aircraft therefore became very expensive. The use of temporary fixes also caused additional maintenance manhours. The lack of spare parts had a direct bearing on the in-commission rates of combat aircraft and on combat sortie productivity.

The bases near the combat areas performed as much maintenance as was possible to keep the aircraft ready for combat. One of the major drawbacks to the bases in Korea was that they often had to quickly relocate due to enemy movements. This meant that maintenance units had to operate with sparse facilities and keep the tools and equipment in boxes to allow for quick movement to different sites. The quality and quantity of maintenance available was dependent on three things: (1) whether or not the units' aircraft were also being maintained through the use of REMCOs; (2) the amount and quality of the facilities and equipment available; and (3) the amount of skilled and experienced maintenance personnel available. The facilities at nearly all the sites was meager at best. Lack of housing and maintenance buildings put a severe strain on maintenance units to provide the proper care the aircraft required.

The rotation and manning policies of the Fifth Air Force allowed for maintenance and supply personnel to only serve for a one year period in Korea. During this short period, personnel had to receive OJT to qualify then to accomplish the maintenance activities. This left only approximately nine months of the twelve to provide the work required to successfully support the combat aircraft.

REMCOs provided excellent aircraft maintenance support to combat units in Korea. REMCOs accomplished major inspections, engine build-up and overhaul, and other field

and organizational maintenance operations. Combat units in Korea using the REMCOs had higher in-commission rates than units which performed all their field and organizational maintenance in Korea. The REMCOs also allowed the forward units more mobility to move. The REMCOs provided excellent supply support and a stable environment in which maintenance operations could be performed.

The major effects of transporting materiel to the Far East theatre from the United States were that (1) materiel was often delayed due to either replacement by higher priority items of other services or lack of sufficient cargo space because of the limited space allocated to the USAF; (2) materiel never arrived because of theft at interim supply depots or the materiel was sent to the wrong place; and (3) materiel was damaged, such as corrosion on aircraft shipped on the decks of tankers. Due to the limited number of transport aircraft, the cargo space allocated to each service had to be determined by a joint service priority board. The board determined the tonnages for airlift capabilities to be assigned each service. The particular use of a service's allocated space was then decided by that service. Materiel sent to the wrong destination was often the result of inexperienced transportation and supply personnel. Corrosion of aircraft by saltwater spray was greatly reduced through shipment of aircraft on the hangar decks of aircraft carriers.

In Korea and Japan the surface transportation was accomplished by truck and railroad. The trucks were used for transporting materiel short distances. The railroads were used to transport the majority of the materiel over most of both countries. All surface transportation in Korea and Japan was controlled by the Army. The USAF units were constantly dependent on the Army for its transportation requirements. Airlift in the theatre was operated by the Air Force but control was provided by the joint service priority board. The board determined the airlift available for each service. Although water transportation (sealift) was performed by the MSTs, the use of the service was controlled by the Army. The inconsistency of control of surface, and often of air, transportation frequently caused USAF combat units in Korea delayed receipt of needed materiel.

The biggest training problem during the war was the lack of proper training for maintenance personnel prior to their arrival in the theatre. Maintenance personnel were assigned to Korea-based units unprepared to service the aircraft in the theatre and much of the in-use equipment. In the theatre, when new aircraft arrived, maintenance personnel had to be trained through OJT or through supervision by contractor technical representatives. Another problem was that when the maintenance personnel were becoming proficient in their maintenance duties it would be time for them to



leave for the United States because their twelve month tour was ending. It would then be time once again to train replacement maintenance personnel. The effects of this lack of expertise on the part of the maintenance personnel lead to extra man-hours being required for the maintenance of aircraft, aircraft and equipment being improperly maintained, and precious maintenance time being used for training instead of performing aircraft maintenance.

The indigenous labor, Korean and Japanese, and the contract technical representatives, provided important, if not crucial, assistance toward aircraft maintenance. Korean labor was used almost extensively for large construction projects: runways, railroads, buildings, and maintenance facilities. They provided the labor at railroad stations and airports, operating the railroads and supporting air terminal loadings and unloadings. They also performed minor aircraft maintenance duties for USAF combat units. Japanese labor provided important contributions supporting depot maintenance in Japan as well as supporting maintenance activities in the REMCOs. The technical representatives provided valuable help instructing military maintenance personnel on maintenance procedures and sometimes directly performed maintenance on aircraft. Most of the time they were the only real source of information for correctly maintaining the combat unit's aircraft and components.

The following recommendations for future aircraft combat maintenance logistics are appropriate for the USAF today and would have also been relevant during the Korean War.

(1) Each service should be responsible for its own combat equipment supply needs. Each service should support the other services whenever possible but none should be fully dependent on the actions or logistics support of another service unless operating as elements of a unified command.

(2) The United States should insure its industrial base is maintained. Without a permanent industrial base to provide quick and efficient supply of military equipment and spare parts, the United States military will merely re-live the logistics problems of the Korean War.

(3) Maintenance and supply depots should be located as close to likely conflict areas as possible. These forward depots should be able to support combat activities quickly, thus reducing transit time and allowing for close contact when problems or emergencies arise. The theatre commander should be able to distribute supplies to meet the needs of the entire theatre.

(4) Maintenance personnel assigned to USAF aircraft units must be qualified to work on the aircraft assigned. They must continually receive supplemental technical data to keep them current on new developments and alternatives for their aircraft and support equipment. Whenever new aircraft or

equipment is brought into the unit, contractor technical representatives and temporary duty assignments for the training of personnel should be used whenever possible. OJT should be used only for working-out specific details and to quickly get the personnel up to speed on the new aircraft and equipment.

(5) Indigenous labor and manufacturing capabilities in the theatre should be used to supplement the military logistics system to rapidly meet emergency requirements. Local procurement would save time by reducing the transportation and administrative time normally required to get the item from the United States. This would probably decrease the ACOP and ANFE rates.

(6) REMCOs were highly effective during the Korean War because the bases where they were located were not target areas. This cannot be assured for future conflicts. Placing large amounts of materiel together could make for easy targets and the loss of such supplies and spare parts could cripple two or more units at the same time. Therefore, the recommendation would be to employ REMCOs, or something similar, when such units can be relatively secure and safe from potential catastrophic damage.

## Glossary

AFLC	Air Force Logistics Command
AMA	Air Materiel Area
AMC	Air Materiel Command
ANFE	Aircraft Not Fully Equipped
AOCP	Aircraft Out of Commission for Parts
CAT	Civil Air Transport
CCC	Combat Cargo Command
CG	Commanding General
COMNAVFE	Commander Naval Force, Far East
DeIR	Depot Inspection & Repair
DIR	Disassemble Inspect and Repair
DTIC	Defense Technical Information Center
FEAF	Far East Air Force
FEALogFor	Far East Air Logistic Force
FEAMCOM	Far East Air Materiel Command
FEC	Far East Command
HQ	Headquarters
IRAN	Inspect and Repair as Necessary
JADF	Japan Air Defense Force
JLCOM	Japan Logistics Command
KAMU	Korean Air Materiel Unit
MATS	Military Air Transport Service
MSTS	Military Sea Transport Service
NATO	North Atlantic Treaty Organization
OJT	On-The-Job Training
PI	Philippine Islands
POL	Petroleum, Oil, and Lubricants
REMCO	Rear Echelon Maintenance Combined Organization
SAC	Strategic Air Command
TAC	Tactical Air Command
TCTO	Time Compliance Technical Order
TOC	Technical Order Compliance

UN  
USAF

United Nations  
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For supplemental readings to provide background  
information see page 144

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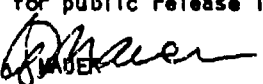
### VITA

Captain James I. Forney was born on 24 December 1960 in Wellingborough, England. After graduating from high school in Big Spring, Texas, he attended the University of Florida. He graduated with a Bachelor of Science Degree in Aerospace Engineering in 1983. He entered active duty in September of 1983 after graduating from and being commissioned at the Officer Training School, Lackland Air Force Base, San Antonio, Texas. His first active duty assignment was to the Air Force Weapons Laboratory, Kirtland Air Force Base, New Mexico. His duties ranged from operating a high energy laser to directing the set-up of vulnerability and effects testing for Strategic Defense Initiative (SDI) projects. In 1987, Captain Forney was selected to attend the Air Force Institute of Technology's School of Systems and Logistics where he was enrolled in the Graduate Systems Management Program earning his Master of Science degree. Captain Forney will be assigned to the Aeronautical Systems Division, Wright-Patterson Air Force Base following graduation in September 1988.

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The objectives of this research ~~was to~~ review historical literature relating to the logistics of aircraft maintenance during the Korean War; determine the principle problems encountered; find the corrective actions; and evaluate the results. The general theme was to provide a brief single source of reference relative to the accomplishment of aircraft maintenance in the combat area during the Korean War. This ~~Thesis~~ report was written to provide helpful insights for solving possible future wartime logistics problems in support of aircraft maintenance. The research discusses how aircraft maintenance was supported by the Fifth Air Force, the Far East Air Force, the Air Materiel Command, and other organizations. The logistics of aircraft maintenance was broken into four areas: (1) maintenance, (2) supply, (3) transportation, and (4) personnel. Each area was discussed by presenting the actions taken by the different Air Force organizations in the Theatre. The lessons learned by the Air Force during and after the war were included ~~in this~~ research paper to exemplify specific areas of concern when planning for or performing future aircraft maintenance operations in a limited conventional war. Keywords: Logistics Planning; Maintenance Management. (Thesis ed.) 4